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PHYSICAL LINES OF FORCE.

Faraday's idea of lines of force has been very useful in both electrical and magnetic theory. These are generally treated as merely imaginary lines which assist the student in fixing his ideas upon the conditions existing in an electric or a magnetic field. But the idea has been so satisfactory for this purpose that many have come to give them something more than an imaginary existence—a convention indicating merely the direction of a force or a line of stress. Indeed, some of the newer ideas of electric phenomena suggest that there may be a physical existence of these lines and that they are really something more than a direction of effect.

One of those who has suggested this physical existence of lines of force is Dr. J. J. Thomson, who says that we may, if we please, give them actual size and shape; and something of this kind seems to be necessary to explain the magnetic effects produced by the motion of the electrical lines of force. Others have also given a physical significance to the lines of force by assuming a molecular or cellular structure of the ether, the lines then being polarized chains of cells or molecules in the ether.

In the April number of the *Physical Review*, Mr. Fernando Sanford considers Thomson's idea and shows how this seems to lead to certain inconsistencies. If we imagine the line of force as a physical reality and then adopt as our unit of electricity the electron, it seems logical to assign to this electron a fixed number of lines of force, one at least. This line of electric force must then start at the negative electron and terminate at an equal positive charge. Every electron then has its line of force, which can not be destroyed, and it would seem to follow from this that this line of force, when once attached to a certain positive charge, could not be shifted to another, for in the shifting it would be broken; yet this assumption leads to the conclusion that no other positive electric charge can exert any force upon that particular electron, as it can only act upon it through its line of force which is permanently attached to another charge.

Another difficulty is to explain the effect of a flow of electric current. Assuming that these electrical tubes of force are attached to the charges which move, then the electrons and positive charges should move out in opposite directions over the two wires and finally neutralize at some intermediate point where the tubes of force collapse. But there is no indication of a movement of positive charges along solid conductors. These are not the only difficulties encountered if this conception of

lines of force be accepted, but it seems clear that there is not at the present time any really satisfactory conception of what constitutes an electrical, or for that matter a magnetic, field, and it hardly seems likely that we will have one until we have a more satisfactory idea of the constitution of the ether than at present.

PROGRESS IN GAS-TURBINE DEVELOPMENT.

The problem of combining the thermal efficiency of the internal-combustion engine with the mechanical simplicity of the steam turbine has attracted the attention of a number of able engineers, but it can not be said that they have yet offered a solution of this problem, nor even demonstrated its probable practicability. Gas turbines, that is to say, rotary engines driven by the expansive force of the heated products of combustion, have been built and operated, but in every case the very severe conditions imposed by the highly heated gases have introduced difficulties in construction which go far toward offsetting the mechanical simplicity sought in this type of prime mover. Not only does the exceedingly high temperature produced by burning fuel under compression introduce severe conditions, but the high speed at which the gases thus heated must be allowed to flow to act efficiently when cooled by expansion also introduces great difficulties. The inventor is thus between two horns of a dilemma. If by expansion he cools his gases to a point where they can be applied satisfactorily for driving the moving parts, they attain speeds far too high for efficient utilization; if, on the other hand, he seeks to reduce the speed by successive expansions of the gases, he obtains in the first stages of this process temperatures too high. One solution of this problem is to lower the temperature of the gases by mixing with them other cooler gases, thus securing a stream of working fluid of greater mass, but lower temperature. In this way both the excessively high temperatures and excessively high velocities may be avoided, but, of course, with a sacrifice in efficiency as stated by the laws of thermo-dynamics.

One who had aided much in the experimental development of the gas department was M. R. Armengaud, who, before his death, had constructed turbines of this type with outputs up to 300 horse-power. In these the principle just alluded to, of lowering the temperature and velocity by admitting cooler gases to the products of combustion, was utilized. Since his death the work has been carried on by Mr. Alfred Barbezat, who in the current number of *Cassier's Magazine* tells what progress has been made during the past year. The difficulty of finding a material to resist the high temperature reached in the combustion chamber and the erosive action of the hot gases in their passage through the expanding nozzle has been met partially by the use of carborundum. The chamber and the nozzle are lined with this material, and it is backed with a soft packing of asbestos to allow for expansion. When the turbine is in operation this lining becomes sufficiently hot to ignite the fuel as it is forced into the chamber.

Another problem met in this work was to secure an efficient supply of compressed air. Since the burning of the fuel in the combustion chamber produces a high pressure, both it and the necessary air must be forced into this chamber against this pressure. When a liquid fuel is employed there is not much difficulty, but it is more troublesome to supply the necessary air, and when an excess of air is used in order to lower the temperature of the issuing gases, additional work is thrown upon the compressor. The compressor now in use is of the multiple turbine type designed by Rateau, it being thought that, since in a turbine the object was to get away from reciprocating mechanisms, the use of a reciprocating air-compressor would be absurd, as a complete turbine unit should consist of rotary mechanisms only. This argument does not seem to be entirely conclusive, for even admitting that a rotary engine is more desirable than one utilizing reciprocating motion, this is no reason why a reciprocating air-compressor should not be used if it were more efficient than a rotary one. It may be an objection that a reciprocating compressor can not be driven efficiently from a high-speed prime mover, but in these days of electrical auxiliaries the compressor might very logically be driven by an electric motor drawing its power from the main generator. It is, of course, assumed that these turbines will be mainly used for generating electric power. For starting, a store of compressed air would be necessary, but this is now standard practice for starting many reciprocating gas engines.

The efficiency obtained by the latest machines, which were rated at about 300 horse-power, is said, by Mr. Barbezat, to be not so high as that of reciprocating gas engines. It is to be regretted that he could not give definite figures; but these are promised later. This statement has no reflection upon the gas turbine and merely indicates its present stage of development. Better results may be expected and some of the losses now taking place will be avoided. It is interesting to note one method at present adopted for this purpose. It has been found necessary to cool, by means of water jackets, the combustion chamber and the expansion nozzle and perhaps other portions of the turbine. The water thus heated is forced into the combustion chamber, where it is converted into steam, with a consequent lowering of the temperature of the driving gases, and thus lightening the work of the air-compressor, which otherwise would be required to supply a much larger volume of air.

Perhaps one of the greatest drawbacks to this type of prime mover is, what may be called by analogy, its low power-factor. This is due to the necessity for an air-compressor which absorbs about half the total power of the turbine proper. That is to say, a gas turbine with an output of 300 horse-power actually develops about 600, 300 of which is necessary to drive the compressor. This 300 horse-power utilized by the compressor is not, of course, lost. It is merely negative work in the compressor and positive work in the turbine. It represents, as it were, fifty per cent of the total power of the turbine circulating between it and the compressor, neglecting, of course, losses; and consequently the turbine itself has but half the rating it would have were not this condition present.

THE EFFECT OF THE CONDITION OF THE AIR ON THE TRANSMISSION OF ELECTRIC WAVES.

During a recent address on the progress of transatlantic telegraphy Mr. William Marconi discussed briefly the difficulties caused, it is believed, by the condition of the air. This effect was noticed first in 1902 during the experiments conducted on board the steamship Philadelphia, when she received signals over a distance of about 2,000 miles. The peculiar effect was attributed to the rays of the sun and was most evident during two comparatively short periods of the day—that is, during the time when it was day at one station and night or twilight or dawn at the other. The transmission during the day is not as good as at night, but conditions even then are better, because more constant, than during the periods of change from day to night or night to day. An interesting line of investigation was suggested by Mr. Marconi with the object of throwing further light upon this peculiar effect. His idea is to see whether these difficulties in transmission will be present when telegraphing over a comparatively long distance in a due north and south direction. Another difficulty encountered by Mr. Marconi was the interference with transmission caused by storms crossing the path of the waves. This effect was not observed if the entire region between the two stations was stormy; it was only noticed when bad weather prevailed over but a part of the route.

In this connection it is interesting to recall the effect of radioactive substances upon the air as explained by Dr. J. J. Thomson during a recent address. This emanation, it will be remembered, is believed to be given off into the air from the earth. Its effect is to set free ions, or charged particles, which cause the air to become conductive, and as the emanation is given off from the earth, and not from the sea, it should be more effective over land than over water. Hence the air over land should be a better conductor of electricity, and for this reason might be expected to interfere more strongly with the transmission of electric waves. This is in accord with the experience in wireless telegraphy, transmission being much better over water than over land. It is rather difficult to establish a direct connection between the conductivity of the air and the quantity of emanation present, but some recent results, due to Eve, are in accord with this idea. Eve found that there was enough emanation in the air to account for its conductivity.

This radioactive emanation, it seems, is not entirely due to radium, as is generally assumed, but part of it may be attributed to thorium. A study of this condition has been made by Mr. H. M. Dadourian, and his results are given in the April issue of the *American Journal of Science*. By studying the rate of decay of the secondary radioactivity due to exposure of wires to the open air, and in a covered well, he found that for New Haven, Ct., from one-fifth to one-third of the initial ionization of the air was due to the thorium products and the balance to radium products.

It is evident that there is still a great deal to learn regarding the electrical properties of the atmosphere, particularly as they affect the transmission of electric radiations, and it is rather interesting to see how two very different lines of research, that started by Hertz and that resulting from Becquerel's chance observation, have thrown out branches which are now in contact.

There is another thought suggested by the experience in long-distance wireless telegraphy. Several investigators have found conditions which seem to indicate that there is a fairly good conducting layer of air fifty miles up or thereabouts. This, at times, seems to be continuous and at other times more or less broken up into clouds, and it has been suggested that it is due to the ultra-violet rays of the sun's light, which do not penetrate our atmosphere. It will be remembered that Arrhenius suggested that the earth's electric charge might be due to charged particles which are thrown out by the sun, some of which should be intercepted by our planet. Dr. J. J. Thomson, however, does not accept this hypothesis, as he does not believe that these particles can pass through the atmosphere and reach the earth; they may give rise to auroras, but do not give the earth its negative charge. It is possible, however, that these particles may have something to do with the ionization of the upper layers of the atmosphere, bringing about this effect instead of the ultra-violet light, or, perhaps, assisting the latter.

THE TELEPHONE IN PUBLIC CRISES.

The immense importance of the telephone in times of emergency has not for a long time been better illustrated than in the case of the six-million-dollar conflagration which visited the city of Chelsea, Mass., on Sunday, April 12. Early in the course of the fire the local exchange of the New England Telephone and Telegraph Company was destroyed by the flames. Relief measures were taken largely with the aid of the telephone service remaining intact in other cities and towns of the Boston metropolitan district, and, through the use of the company's toll lines, tents and blankets were ordered from the state arsenal in South Framingham, twenty-five miles distant from the scene of trouble. The Boston & Worcester electric road was thus able to bring a large store of these necessary supplies to Boston in time to save many of the homeless sufferers from spending the night unsheltered.

With the resumption of temporary telephone connections on Monday, focussed in rough shacks hastily built on the fire-swept section by the New England company, the task of directing the clearing up of the worst débris, the feeding and sheltering of the unfortunate persons who lost all their possessions in the catastrophe, and the preservation of order by the state militia, became much easier. The resumption of even these temporary lines of communication enabled the relief committee and the officers of the militia to work in better co-operation, and emergencies arising from the pressure of travel into the burned district, and the occurrence of disorder at widely separated points, were promptly handled by the aid of the telephone. The facility with which the telephone lends itself to prompt action in times of the most urgent crises justifies the statement that no electrical device ever invented is more indispensable or more vitally necessary to civilized life.

Thirty-first Convention of the National Electric Light Association.

The thirty-first convention of the National Electric Light Association will be held at the Auditorium Hotel, Chicago, Ill., May 19-22. The various committees have been working very energetically and the present indications point to a very successful gathering.

For the benefit of the New England delegation arrangements have been made for special sleeping cars to be attached to the through train for Chicago leaving South Station, Boston, Mass., on Sunday, May 17, at 10.30 A. M., due in Chicago on Monday, May 18, at 12.55 P. M., the day before the convention opens. The train will run *via* the Boston & Albany, New York Central and Lake Shore & Michigan Southern railroads.

George F. Porter, master of transportation, 120 Liberty street, New York city, is making arrangements for a special train to leave New York on Sunday forenoon, May 17, for the accommodation of the New York, Newark, Philadelphia and Pittsburg delegations. This train will be run special and be first-class in every particular. Members in southern New England who desire to go on that train should communicate with Mr. Porter at once. Members who wish to go on the special cars from Boston should send their names at once, specifying what accommodations are desired, to C. H. Hodskinson, master of transportation for New England, 70 State street, Boston, Mass.

The following tentative programme has been announced:

Monday Evening: Reception in new banquet room—opening of the exhibition.

TUESDAY—MORNING SESSION, 10 A. M.

President's address.

Report of Committee on Progress, T. C. Martin.

"Distribution in Suburban Districts," G. H. Lukes.

"Tape," Paul Lüpke.

Report of Committee on Grounding Secondaries, W. H. Blood, Jr., chairman.

AFTERNOON SESSION, 2.30 P. M.

"Series Incandescent Lighting with Tungsten Lamps," P. D. Wagoner.

"Power-Load Development for Central Stations of Moderate Size—Some Unappreciated Possibilities," J. R. Bibbins and Charles Robbins.

"The Small Station and Its Economical Operation," J. T. Whittlesey and Paul Spencer.

"Question Box," A. J. Campbell, editor.

Report of Committee on Uniform Accounting, H. M. Edwards, chairman.

WEDNESDAY—MORNING SESSION, 10 A. M.

"Low-Pressure Steam Turbines," J. W. Kirkland.

Report of Committee on Meters, L. A. Ferguson, chairman.

Report of Committee on Gas Engines, W. C. L. Eglin, chairman.

"Receiving Stations Operated from High-Tension Lines," S. Q. Hayes.

"Observations on the Precision of Different Types of Photometer," A. E. Kennelly and S. E. Whiting.

Parallel Session — "Accountants" — Sixth floor banquet hall.

EVENING SESSION, 8 P. M.

Executive session.

Report of secretary and treasurer and executive committee.

Report of insurance expert, W. H. Blood, Jr.

Report of Committee on Public Policy, Arthur Williams, chairman.

Report of Committee on Organization Possibilities, Henry L. Doherty, chairman.

"The Status and Commercial Possibilities of High-Efficiency Lamps," W. W. Freeman.

Report of Committee on Rates and Costs, R. S. Hale, chairman.

Election of nominating committee.

THURSDAY—MORNING SESSION, 10 A. M.

Commercial Day: C. W. Lee, chairman Programme Committee; Henry L. Doherty, special chairman.

AFTERNOON SESSION, 2.30 P. M.

Report of Committee on Solicitors' Handbook Prize Award, J. F. Gilchrist, chairman.

Report of Committee on Co-operative Electrical Development, W. W. Freeman, chairman.

FRIDAY—MORNING SESSION, 10 A. M.

"Illuminating Engineering," W. D'A. Ryan.

Report of Committee on Protection from Lightning and Other Static Disturbances," Robert S. Stewart.

"The Value of Care and Maintenance of Meters," H. D. King.

"Some Experiments in Combustion," S. J. Lenher.

"Specifications for Construction on Joint Poles," Paul Spencer.

EXECUTIVE SESSION.

Election of officers.

Adjournment.

The exhibit by Class D members promises to be very extensive this year. It is announced that practically all of the exhibit space has already been acquired. A convention daily will be published by the C. W. Lee Company. The other national engineering papers will all be represented.

The following members will participate in the exhibition:

General Electric Company, Westinghouse Electric and Manufacturing Company, National Electric Lamp Association, ELECTRICAL REVIEW, Crocker-Wheeler Company, Duncan Electric Manufacturing Company, Federal Electric Company, Allis-Chalmers Company, Western Electric Company, Philadelphia Electric and Manufacturing Company, Simplex Electric Heating Company, *Electrical World*, the C. W. Lee Company, the Triumph Electric Company, Fort Wayne Electric Company, H. W. Johns-Manville Company, Wm. D. McJunkin Advertising Agency, Wagner Electric Manufacturing Company, Dossert & Company, Sangamo Electric Company, Electric Appliance Company, Minerallac Company, *Western Electrician*, Pettingell-Andrews Company, the Gage Publishing Company, B. S. Barnard & Company, the Illuminating Engineering Publishing Company, G. M. Gest, Spencer Turbine Cleaning Company.

Semi-Annual Meeting of the American Society of Mechanical Engineers.

The semi-annual meeting of the American Society of Mechanical Engineers will be held in Detroit, Mich., June 23-26. Among the papers to be presented at this session are "A Method of Cleaning Gas Conduits," by W. D. Mount; "A Method of Checking Conical Pistons for Stress," by Professor George H. Shepard; "Clutches," with special reference to automobile clutches, by H. Souther; "Horse-Power, Friction Losses and Efficiencies of Gas and Oil Engines," by Professor L. S. Marks; "Some Pitot Tube Studies," by Professor W. D. Gregory; "The Thermal Properties of Superheated Steam," by Professor R. C. H. Heck; "A Journal Friction Measuring Machine," by Henry Hess; "A By-Product Coke Oven," by W. H. Blauvelt; "Tests of Some High-Speed Steam Engines," by F. W. Dean. There will be a symposium upon machinery for conveying materials, with papers by several authorities. The Society for the Promotion of Engineering Education and the Society of Automobile Engineers will also hold their annual meeting in Detroit at this time, which will enable members of each society to participate in the sessions of the other.

FINANCIAL REPORTS OF ELECTRIC COMPANIES.

AMERICAN DISTRICT TELEGRAPH COMPANY.

The annual report of the American District Telegraph Company for the year ended December 31, 1907, shows gross income of $3,017,174; expenses, $2,304,214; net income, $712,960, equal to 7.17 per cent on the $9,925,350 capital stock. The dividends paid were $396,899, leaving a surplus of $316,061, which, added to the previous surplus, makes a total surplus of $1,246,570.

LONG ISLAND RAILROAD COMPANY.

The annual report of the Long Island Railroad Company shows an increase in gross earnings of $534,811, or 5.6 per cent. This was more than offset by an increase in operating expenses of $1,045,422, or fourteen per cent. The income account shows a deficit of $858,828, against a deficit in the previous year of $28,359. This is due to extraordinary expenses and to an increase in taxes and fixed and other charges amounting to $201,032, which includes the payment of interest on equipment trust certificates and interest on advances made by the Pennsylvania Railroad Company for the purpose of carrying on improvements. The gross earnings were $10,130,470; the expenses, $8,526,584; rents, $200,147, making the net operating earnings $1,403,676; other income amounted to $332,069, and charges, taxes, etc., totaled $2,594,573.

At the annual meeting all the directors were re-elected, with the exception that Frederick G. Bourne was added to the list to take the place of Franklin B. Lord, deceased.

MICHIGAN STATE TELEPHONE COMPANY.

The directors of the Michigan State Telephone Company have declared the regular quarterly dividend of one and one-half per cent on the preferred stock, payable August 1. Quarterly dividends of one per cent each, or at the rate of four per cent per annum, were declared on the common stock, payable June 1 to stock of record May 16.

At the annual meeting of the company D. W. Briggs, vice-president of the Bank of Saginaw (Mich.), and Russell A. Alger, of Detroit, Mich., were elected directors to succeed Elwood T. Hance, deceased, and W. A. Jackson, who declined re-election. Other directors were re-elected. John T. Shaw, president of the First National Bank of Detroit, was elected chairman of the executive committee.

CONNECTICUT RAILWAY AND LIGHTING COMPANY.

The financial statement of the Connecticut Railway and Lighting Company for the nine months beginning July, 1907, and ending March 31 last, shows the income of the company to have been $778,737.70, with expenses of $514,419.86. The net profits were $264,317.84. Dividends on the preferred and common stock of the company totaled $402,545 for the period mentioned. The total assets of the company are given as $33,899,201.07, of which $31,878,800.50 is represented by equipment and construction. The funded debt of the company is given as $13,465,700. The company is leased to the Consolidated Railway Company for a period of 999 years on a four-per cent dividend basis, the payment of which is guaranteed by the New York, New Haven & Hartford Railroad Company.

At the annual stockholders' meeting the following directors were elected: Walton Clark, W. T. Hinks, Lewis Lillie, Randall Morgan, A. W. Paige, E. G. Runkle, Charles S. Sanford, A. C. Shepardson, R. A. C. Smith, M. J. Warner and A. M. Young. At the meeting of the directors the following officers were elected: A. M. Young, president; R. A. C. Smith, first vice-president; Randall Morgan, second vice-president; Lewis Lillie, treasurer; James Ball, assistant treasurer; W. S. Dougherty, secretary, and G. S. Philler, assistant secretary.

The Home Show in New York City.

The Home Show will be held in the Grand Central Palace, New York city, from May 2 to May 9, inclusive. A large part of the floor space at the Palace will be given over to the exploitation of electrical supplies and conveniences for all parts of the house. In addition, there will be complete exhibits of material used in the construction and exterior and interior decorations of the home. The exhibition will include every conceivable article for completing and furnishing the house, and over eighty exhibits, totaling space reservations of nearly 15,000 square feet, have already been secured.

Trouble for the Missouri River Power Company.

Floods in Montana last week resulted in the bursting of the Hauser Lake dam, great damage being done to the town of Craig and a portion of the electrical development of the Missouri River Power Company, of Helena, Mont.

The American Circular Loom Company.

As was briefly announced in last week's issue of the ELECTRICAL REVIEW, the plant of the American Circular Loom Company, at Chelsea, Mass., was destroyed by fire in the conflagration which swept over that city the week before last. The fire started about two miles from the factory, and the entire Chelsea plant, consisting of the "Circular Loom" factory, warehouse, stables and home offices, was completely destroyed. The loss was fully covered by insurance. The factory employés suffered severely, nearly all, living, as they did, in the vicinity of the factory, losing house and home and all they possessed. Some of the employés were injured, and one—a young woman—was burned to death.

The company has lost no time in getting started again. It has already secured a new factory, admirably adapted to its needs, in North Cambridge, Mass. New permanent offices have been established in the International Trust Building, Boston, Mass. The company is actively engaged in assembling with all possible speed new machinery for the manufacturing of "Circular Loom," and will be able to supply the demand regularly and promptly within a very short time.

The company's other facilities have in nowise been affected by the Chelsea fire. The "Electroduct" factory, at Kenilworth, N. J., is in full operation, and the new "Metal Molding" factory, also located at Kenilworth, is now fully completed, including a large electro-galvanizing plant. The "Lutz Metal Molding" will be offered to the trade as soon as the necessary printed matter, which was stored at the home offices, and burned up, can be duplicated.

Navy Department Supplies.

The Bureau of Supplies and Accounts will open bids in Washington, D. C., on April 28 for the following electrical material: 6,000 feet of cable, 13,000 feet rubber-covered wire, for delivery at Brooklyn, N. Y.; 34,000 feet cable, miscellaneous silk cord, miscellaneous electrical supplies, miscellaneous lighting wires, miscellaneous micanite, for delivery at League Island, Pa.; miscellaneous electrical supplies and miscellaneous lighting wire, for delivery at Boston, Mass.; 550 feet of magnet wire, for delivery at Norfolk, Va.

The bureau will open bids on May 5 for miscellaneous incandescent lamps, for delivery to all yards, and three motors for delivery at New Orleans, La.

Bids will be opened on May 12 for miscellaneous cable, four motor-generators and twelve transformers, for delivery at Puget Sound, Wash.

The Maggia Valley, Switzerland, Single-Phase, 5,000-Volt Railway.

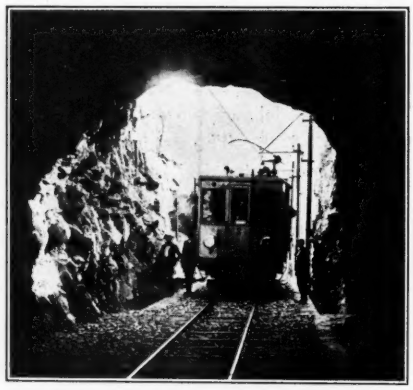
By Frank Koester.

AN electric railway embodying in its design very interesting features was recently opened for traffic in the "Maggia" Valley, running between Locarno and Bignasco, in the Canton of Tessin, Switzerland, utilizing single-phase alternating current at 5,000 volts.

The road begins at Locarno at the northern end of Lake Maggiore and runs in a northwesterly direction alongside the county road, passing the town of Solduno, above which it runs over the Pontebrolla bridge. This passes over the Maggia River and is an old structural-steel arch bridge, with a span of sixty-five feet, which was widened for this purpose. Directly above this bridge, at Pontebrolla station, the road crosses the river once more over a lattice-girder bridge. The span, which is 180 feet, is carried between massive masonry piers from which masonry arches are sprung continuing the bridge on either side, there being three such arches, each having a span of eighty-two feet. The remainder of the road runs along the mountain slope in which, at places, tunnels and cuts had to be made. At other places heavy retaining walls have been built. In some parts the tracks run on these retaining walls as much as fifty-five feet above the county road; at other points the railway runs at a lower level than the road. There are nine bridges and tunnels before the terminus of the road at Bignasco is reached. The tunnels, of which there are two, are respectively 160 feet and 570 feet long. The bridges, of which there are seven, range from thirty-three feet to 246 feet in length, the largest being composed of three arches. Although many cuts had to be made and valleys spanned, the conditions as a whole were very favorable. The entire length of the road is seventeen miles, in which distance there is a rise of 740 feet, the steepest grade being thirty-three feet to the thousand. The smallest curve is on a radius of 330 feet.

Current is drawn from the power-house at Locarno, where two hydroelectric units of 600 horse-power each were originally installed. With the increased demand for light and power, a third unit of the same capacity was installed simultaneously with two 660-horse-power units for operating the railway system, one of the latter being kept in reserve.

The head-race water is conducted through a tunnel 2,600 feet long, the inlet of which is well provided with sluice-gates, screens and sand trap, to a collecting basin from which two penstocks



Motor-Car Entering Tunnel, Maggia Valley Railway.

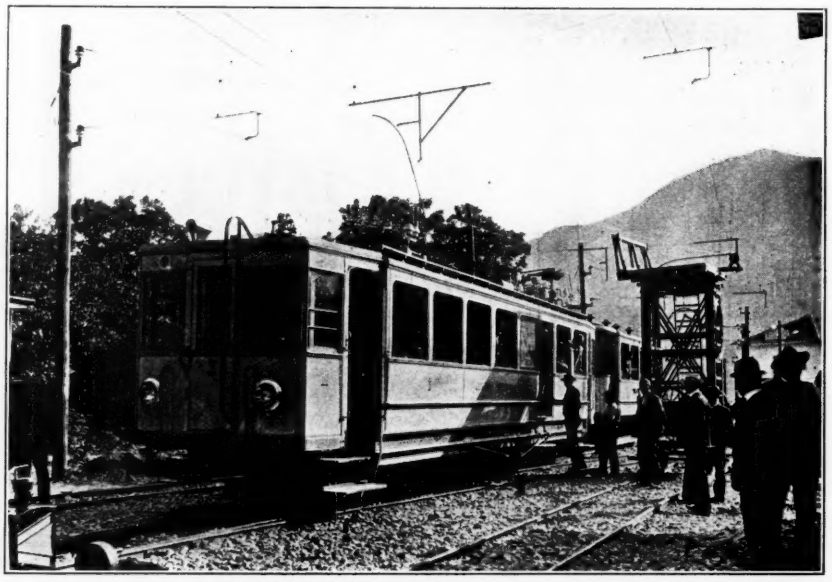
of 4.9 feet diameter lead to the power-house under a head of 128 feet.

The turbines, which are of the Bell Company manufacture, horizontal type, are direct-connected to the generators by insulated flexible couplings. Owing to the fluctuation of load of the railway system and to save the expense of hydraulic governing devices, the two generator units installed for this purpose were equipped with flywheels, of which the couplings form a part.

The generators are of the Oerlikon make, which company also furnished the entire equipment for the railway system. They are 5,000-volt, twenty-five-cycle, single-phase alternators, running at 600 revolutions per minute. They develop a normal capacity of 380 kilowatts, with a power-factor, cos. $\Phi = 0.8$, and for a two hours' run they will develop a capacity of 450 kilowatts, and for a shorter period 550 kilowatts.

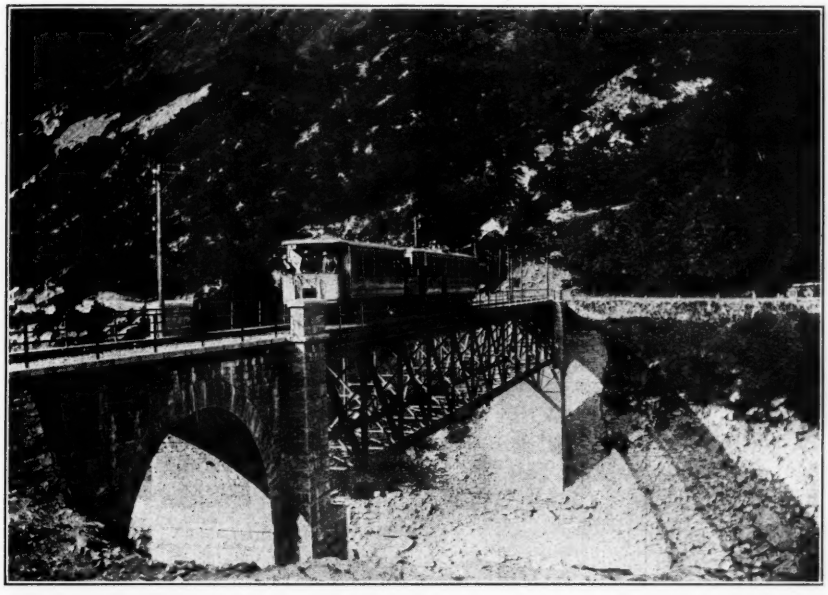
With the installation of the new generator units the old switchboard was abandoned and an entirely new switch-gear was installed, and all high-tension apparatus was placed in individual concrete cells, which has been the Swiss practice for some years. The current is taken directly from the bus-bars to the trolley or contact wire.

The poles are placed with reference to the centre of the track, as is the usual practice, but the distance of the wire from the poles varies from six to forty inches, depending upon the radius of track curves. At railroad stations, tunnels, crossings and switches, the wire is placed as near as possible to the centre of the track. The minimum height of the contact wire above grade is fourteen feet, while at free stretches and at stations it is sixteen feet. The maximum height of the contact wire above grade, which occurs above switches, is 17.4 feet. The trolley wire is five-six-

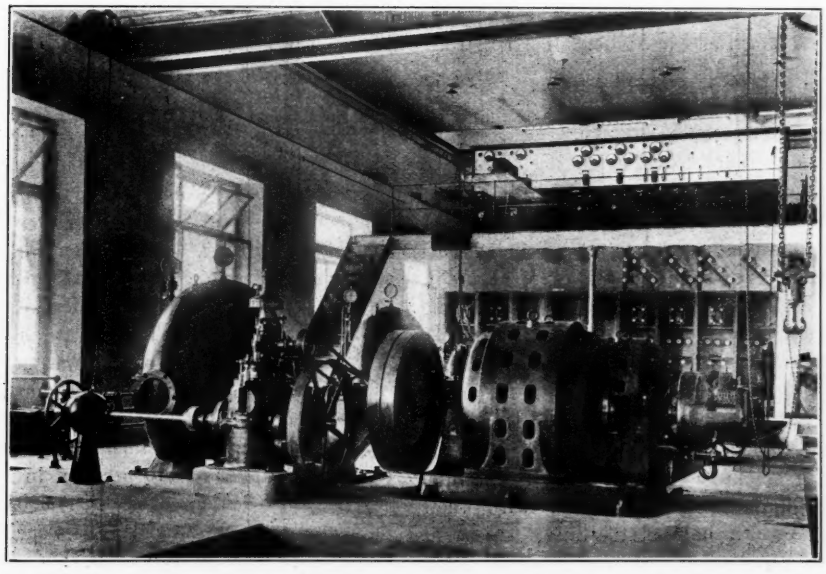


Motor-Car at Switching Point, Maggia Valley Railway.

teenth-inch hard-drawn copper. As the power plant is located about three miles from the starting point of the railway, the current is carried the remaining fourteen miles by a single feeder. With a voltage of 5,000 the loss in pressure in feeder and return is ten per cent when the trains run on schedule time, namely, one train ascending while another is descending the mountain. If, however, schedule time is not maintained and more trains are ascending the mountain than are descending, the drop in pressure may reach a maximum of from twelve to thirteen per cent.



MOTOR-CAR AND TRAILER AT PONTEBROLLA BRIDGE, MAGGIA VALLEY RAILWAY.



TURBO-GENERATOR UNIT AT LOCARNO PLANT IN PONTEBROLLA FOR OPERATING THE MAGGIA VALLEY RAILWAY.

The contact wire, over its entire length, is divided into sections. For this purpose a one-eighth-inch iron wire running along the line is connected to relays of the section switches, which are located at the railway stations and principal stopping points. These section switches may be operated by hand, or, in case an insulator should break, the live wire comes in contact with the insulator-carrying bracket, which is electrically connected to the relay and switch, which are grounded. The insulators are supported in a sleeve, so that in case the contact wire should break in any section the insulator is caused to rotate in this sleeve, thus causing a stiff piece of wire clamped to the insulator to come in contact with the above-mentioned insulator bracket and cutting out the impaired section of the line.

The cars are 52.5 feet long by 8.8 feet wide. They are carried upon two four-wheeled trucks spaced 24.6 feet apart. The axles of each truck are on 8.2-foot centres. Each truck is provided with two sixty-horse-power, 200-volt motors. For the purpose of operating the trains as used for the present traffic, forty-horse-power motors would be sufficient, the greater capacity being provided for future conditions. Two motors of one truck are always kept in series and are geared to the drivers in the ratio of 1 to 5.15.

The motor-cars are divided in second and third-class compartments, between which there is a mail and baggage compartment, which is 8.2 feet long. The third-class compartment is arranged for smokers and non-smokers, the former having seating capacity for twenty-four and the latter for eight. Including second-class, the seating capacity is forty-four.

Current is collected by a novel device known as the "Oerlikon." The collector consists of a bent rod contacting with either the bottom, side or top of the wire, depending upon its relative position to the motor-car. Each car is provided with two such collector rods, one of which is sufficient for regular operation, which may be lowered or raised from the platform of the car, both being connected to a horn lightning arrester on the top of the car and to the high-tension room located in the baggage compartment. The latter is made of structural steel and lined with asbestos cement. This room contains all high-tension switches, which may be operated either by hand, electrically or pneumatically. Two oil-transformers, each of ninety kilowatts' capacity, are carried beneath the car body.

As the Maggia Valley Railway cars are in future to run through the town of Locarno, running over the existing tramway to the St. Gothard Railway, they had to be provided with apparatus for single-phase, 800-volt working. For this purpose the transformers have a winding for 800 volts, as well as the winding for 5,000 volts. As the overhead trolley to the St. Gothard Railway is provided with bow-sliding contact, these cars were also so provided. Consequently, the only change necessary at the junction station is the simultaneous lowering of one and elevating of the other collecting rod, the unused rod being locked in position. Each car is provided with two air-brakes and two air-compressors.

American Institute of Electrical Engineers.

The annual meeting of the American Institute of Electrical Engineers will be held on Tuesday, May 19, in the Engineering Societies Building, New York city. This is the third Tuesday in May. In addition to the routine reports the following papers will be presented: "Comparative Tests of Lightning Protection Devices on the Taylors Falls System," by J. F. Vaughan; "Studies in Lightning Performance, Season of 1907," N. J. Neall.

The annual convention of the Institute will be held at Atlantic City, N. J., June 29 and 30 and July 1 and 2. These papers are expected:

"Voltage Ratio of Split-Pole Converters," Comfort A. Adams.

"A New Large Generator for Niagara Falls," B. A. Behrend.

"Relation of the Manufacturing Company to the Technical Graduate," B. A. Behrend.

"Experimental Observations of Electrical Stresses, Caused by Arcing Grounds," Ernst J. Berg.

"Steam-Turbine Plant, Some Possibilities Resulting from Recent Engineering Developments," J. R. Bibbins.

"Thirty-Day Test on Producer-Gas Power Plant, Discussion of Results in Relation to Cost of Power," J. R. Bibbins.

"Three-Phase Power Factor," Austin Burt.

"A Study of Automatic Switchboard Telephone Systems," W. Lee Campbell.

"A New Method for the Design of Alternators," Carl J. Fechtheimer.

"Wireless Telephony," R. A. Fessenden.

"Conductor Rail Measurement," S. B. Fortenbaugh.

A paper on certain features of the Southern Power Company's system, J. W. Fraser.

"Notes on Electric-Locomotive Tests," George Gibbs.

A paper on electric fire-hazard problems, C. M. Goddard, representing the National Fire Protection Association.

"Notes on the Development of Electric Heating," W. S. Hadaway, Jr.

"Graphic Treatment of the Rotating Field," R. E. Hellmund.

"An Imperfection in the Usual Statement of the Fundamental Law of Electromagnetic Induction," Carl Hering.

"Ventilation of High-Speed Alternators," Albert Kingstung.

"Modern Developments in High-Speed Motor-Generator Sets," F. D. Newbury.

"Relation of the Manufacturing Company to the Technical Graduate," L. A. Osborne.

"A Minimum-Work Method for the Solution of Alternating-Current Problems," Harold Pender.

"The Design of High-Tension Water Power Stations," D. B. Rushmore.

"Relation of the Manufacturing Company to the Technical Graduate," D. B. Rushmore.

"The Fundamental Considerations Governing the Design of Transmission-Line Structures," D. R. Scholes.

"The General Equations of the Electric Circuit," C. P. Steinmetz.

A paper on the electric heating plant at Biltmore Estate, North Carolina, Charles E. Waddell.

"On the Economical Location of Substations in Electric Railways," Gerard B. Werner.

"From Steam to Electricity on a Single-Track Road," J. B. Whitehead.

"The Application of Storage Batteries to the Regulation of Alternating-Current Systems," J. Lester Woodbridge.

Other papers are being arranged for by the High-Tension, the Railway and the Educational sub-committees.

The College of the City of New York.

The dedication exercises of the new buildings of the College of the City of New York, at St. Nicholas Terrace, New York city, will be held on the morning of Thursday, May 14. The city secured the present site ten years ago. The grounds include four blocks, extending from One Hundred and Thirty-eighth street to One Hundred and Fortieth street, and from Amsterdam avenue to St. Nicholas Terrace. Five new buildings were begun in 1903. The main building contains the administrative offices, the assembly hall, lecture and recitation rooms and laboratories. There are, in addition, the chemistry building, the mechanic arts building, the academic building, known as Townsend Harris Hall, and the gymnasium. These buildings constitute, with their equipment, one of the most important groups of structures ever constructed for college uses in this country.

The general exercises of dedication will be held on the morning of the 14th, and after ceremonies attending the raising of the national and city flags in the plaza and on the tower, the academic procession will pass to the great hall, where addresses will be delivered. In the afternoon special buildings and departmental rooms will be formally opened with appropriate ceremonies.

The college was chartered in 1847 as the Free Academy, and is maintained and entirely supported by the city of New York for the higher education of the sons of its residents.

Nebraska Electrical Association.

The annual meeting of the Nebraska Electrical Association will be held at Omaha, Neb., on May 6 and 7. The chairman of the Programme Committee, L. E. Watson, Beatrice, Neb., announces the following papers:

"Duties of the Electrical Inspector," Waldemar Michaelson, city electrician, Omaha.

"Electric Law," Hon. W. R. Patrick, senator from Douglas County.

"Electric Rates," Homer Honeywell, Lincoln Gas and Electric Light Company; I. B. Zimman, Omaha Electric Light and Power Company.

"The Motor Problem from the Standpoint of Small Central Stations," W. V. Bergenthal, Wagner Electric Manufacturing Company.

"How to Meet Gas and Gasolene Competition in Stoves," J. R. Cravath, Chicago, Ill.

The officers of the association are T. H. Fritts, Grand Island, president; R. D. Russell, Fairbury, vice-president; William Bradford, Lincoln, secretary; E. V. Capps, Blair, treasurer.

Receiver in London.

Sir George Gibb, chairman and managing director of the Metropolitan District Railway Company and the Underground Electric Railway Company, of London, England, has been appointed receiver for the latter company. Application for receivership was made by Speyer Brothers, bankers, who are the largest holders of the company's securities. There was no opposition to this action, which was necessary in order to avert the possible shutting down of all the lines by action of smaller creditors. The readjustment plan contemplates an offer of 110 per cent in new securities to holders of the $35,000,000 notes maturing on June 1. The securities will probably be in two classes: one an issue of four and one-half per cent bonds, and the other an issue of six per cent income bonds. Every holder of a $1,000 note will receive $400 in the former class and $700 in the latter. In case note holders accept the proposition, the Speyers and other bankers will guarantee the company $1,500,000 in cash as a protection against any future deficit in interest charges of the company.

NOTES ON LOS ANGELES, CAL.

BY H. THURSTON OWENS.

Los Angeles, Cal., has been called the eastern city of the coast, and many of its disagreeable features are eastern indeed. Narrow streets, in bad repair; ugly skyscrapers, and crowded overhead trolleys in great abundance are there.

The illustration herewith shows the main street of the city, Spring street, looking north from the Alexandria Hotel. All of the local trolleys pass through the city in two directions, as well as the suburban lines. This means that a great many cars are continually passing at all hours of the day. As the cars can not pass upon some of the curves, signal towers have been erected, as is well shown.

SPRING STREET, LOOKING NORTH FROM THE ALEXANDRIA HOTEL, LOS ANGELES, CAL., SHOWING STREET CROSSING SIGNAL TOWER AND ORNAMENTAL LIGHT STANDARD.

The ornamental lamp is of Italian Renaissance style and is one of 594 which have been installed upon the principal streets at the expense of the property owners, the cost being $110 each. They are erected opposite each other about 120 feet apart, with four at each street intersection. The lighting equipment consists of one sixteen-inch and four twelve-inch frosted globes enclosing three sixteen-candle-power and three eight-candle-power bulbs, respectively. All lamps burn from dusk until midnight and two at each intersection after that time.

The city pays for the lighting and maintenance, amounting to $57.50 per year for the first year and one-half, thereafter the balance is assessed upon the property owners. The result has been praised to such an extent that it seems hardly necessary to state that no city in the world may claim a superior installation.

A very important feature has been neglected up to the present time and that is uniformity. The intersecting streets have no lamps at all, and, as they measure approximately 400 feet, the results are very bad.

Outside of the show district the lighting is done by alternating-current enclosed 6.6 ampere arcs with clear inner and no outer globes, suspended at the street intersections. The blocks here are 800 feet long and the lighting conditions much worse than upon the shorter unlighted blocks of the business section.

The "dream books" issued by the transportation companies now include superb street lighting along with climate and oranges, but eastern visitors will tell you that the residence streets are unlighted, and this is true. With a large percentage of the population in the real estate business, and lots of eastern capital being invested in this oasis on the desert, we may look for better lighting conditions in the near future.

The Electrical Resistance of Selenium Cells.

A study has been made by F. C. Brown and J. Stebbins of the effect upon selenium cells of the following actions: Effect of pressure upon the resistance, and light sensitiveness at different pressures; effect of temperature on the resistance and light sensitiveness at different temperatures; effects of hydrogen peroxide on the resistance and of radium. Three types of selenium cell were used which gave concordant results, although certain of these were far more sensitive than others. The effect of pressure was determined by placing the cell in a piezometer submerged in kerosene and then applying the pressure by means of a pump. It is necessary in these experiments to eliminate the effect of temperature rise due to pressure, which is done by means of a copper-resistance thermometer. In determining the effect of temperature the cell was placed in a kerosene bath surrounded by a water bath, which was heated by a Bunsen burner. But few observations were made to determine the effect of hydrogen peroxide. In these the cell was exposed to the vapors of the peroxide which had been poured upon black cloth or paper. The effect of radium was determined by exposing the cells to three milligrammes of about two million activity, while various thicknesses of mica were interposed between the cell and the radium, and the effect noted; also, the distance between the radium and the cell was altered. The following is a summary of the conclusions reached from this study: The selenium cell changes in resistance with a change of the mechanical pressure on its surface. The pressure produces a real change in the resistance of the selenium itself. The percentage of change of resistance for one atmosphere was found to lie between 0.05 and 0.3. This value is a function of the temperature and the electromotive force applied in measuring the resistance. An increase of pressure or a rise of temperature lowers the light sensitiveness of the selenium cell, the resistance falling in each case with a rise of pressure or temperature. The sensitiveness to light is a function of the resistance of the given cell, whether this resistance be conditioned mainly by temperature, light, radium or hydrogen peroxide. The effect of radium and of hydrogen peroxide is to decrease the resistance very markedly, as much as thirty-five and ninety per cent respectively, and in the case of the latter this effect persists and the cell does not begin to recover until the hydrogen peroxide has evaporated. The rate of recovery from exposure to this material is very slow, as is also the recovery from the effects of radium.—*Physical Review, April.*

Civil Service Examinations for New York State and County Service.

The New York State Civil Service Commission will hold examinations on May 9 for the following positions: Assistant civil engineer, $5 to $6 a day; bridge designer, $1,500 to $2,100; bridge draftsman, $1,200 to $1,500; leveler, $4.50 to $5 a day; mechanical draftsman, $900 to $1,500; telephone operators, state and county offices and institutions, $360 to $720.

The last day for filing applications for these positions is May 2. Full information and application forms may be obtained by addressing Charles S. Fowler, chief examiner, Albany, N. Y.

SHORT TALKS ON CENTRAL STATION ADVERTISING.

BY J. O. LITTLE.

The Display Window.

Ask any successful retail merchant what he would take to let you have the full use of his display windows, and his answer will give you some idea of their advertising value.

You simply couldn't get him to rent you his windows, but you can do the next best retail stores, but that's only an argu- to your own windows. Your windows may not be so favorably located as those of the best retail stores, but that's only an argument for using greater care in dressing them.

If fewer people pass your windows, your aim should be to attract a greater percentage of those who do pass. You may not realize it, but you have in your stock in trade that which is unequaled for attracting attention, moving objects. Without calling in a window trimmer, without any greater effort than it requires to set up a machine or two and turn on the "juice," you can make the merchant who is limited to dress goods, hats and shoes, green with envy.

There is nothing that will draw a crowd so quickly as a moving exhibit. Many devices are rigged up at great expense for display windows just because action is wanted. In the majority of cases these are entirely irrelevant, as, for instance, the clown balancing a ball on a rotating wheel, lately used by the National Cash Register Company in many of its display windows. Such a device does draw a crowd, but most of them watch it a while and turn away without any definite thought about cash registers.

In the case of the central station it is different. The moving object that you use to draw the crowd is the very thing you want to advertise and those who stop to watch it can not fail to receive an object lesson.

This method of advertising is the most direct of all and is far cheaper than newspaper or circular advertising. Naturally the best devices to exhibit in the window are those that have a general application, such as washing machines, sewing machines, fans, etc. A motor-driven sewing machine makes a display that attracts everybody, men and women alike. A girl to operate it makes it irresistible, and when you compare her wages with the cost of other forms of advertising, it is scarcely worth considering. To make the effect complete in advertising value there should be a conspicuous placard containing a terse statement of fact, as for instance:

> Anybody can run it. It costs no more for power than a standard lamp.
>
> It does all the hard work; all you have to do is to feed in the goods. It lasts long enough to reduce its cost to a cent a day.
>
> The electric cure for backache. It will not increase your current bill any more than if you were to use just one more lamp.
>
> Saving the housekeeper at a cent a day for the motor and half a cent an hour for the current.

In connection with the sewing machine a fan with floating streamers can be kept going at one side, bearing some such legend as:

> Makes the hottest office cool and pleasant for less than it costs to burn a single lamp.

Thus you appeal to both the man and the woman.

The washing and wringing outfit also makes an effective window moving-picture and so do many other applications. With the many motor-driven machines that are now on the market, the display can be changed from time to time and always kept so attractive that people will stop to look, whereas they would never think of noticing a "dead" display.

Just as pictures are better than descriptions, the objects themselves are better than pictures and moving objects are better than still ones. The moving displays that it is possible for the central station to keep going should make the windows the most attractive in town. Such displays will accomplish more toward educating the public and making your service popular than wagon-loads of printed matter.

Engineers on Conservation of Natural Resources.

A meeting was held on Tuesday evening, April 14, in the auditorium of the Engineering Societies Building, under the auspices of the American Society of Mechanical Engineers, in response to the invitation of President Roosevelt to engineers to co-operate for securing the conservation of our natural resources. A letter was read from the President expressing gratification at the zeal with which engineers had taken up this problem.

The meeting was presided over by J. W. Lieb, Jr., vice-president of the society, who called attention to the fact that the first President of the United States was an engineer, who was interested in the development of waterways. Dr. W. J. McGee, chief of the Bureau of Soils, Washington, D. C., followed with an address on "The Conservation of the Water and Woods," calling this the most important subject now before the people.

Dr. W. F. M. Goss, dean of the College of Engineering, University of Illinois, spoke upon "The Conservation of the Nation's Fuel Supply," saying that economy in its production and use is to be enforced by a fourfold process. The necessary steps are: Scientific research for the establishment of facts; practical demonstrations of facts thus developed on a scale which will convince men that there is profit, direct or indirect, in a better practice; restrictive legislation which will protect the public from the competition of unscrupulous men, and finally effective inspection which will secure an enforcement of law. The process can not successfully begin with coercion; it must begin with education.

Professor George F. Swain, of the Massachusetts Institute of Technology, Boston, presented the subject of "Stream Flow, Water Power and Navigation." The most effective way of regulating stream flow is by preservation of the forests, and this produces three effects of great importance. It conserves one of our greatest natural resources—water power; it prevents erosion of the soil, and it prevents the silting of navigable rivers and harbors as well as of reservoirs.

The concluding address, by Dr. Henry S. Pritchett, president of the Carnegie Foundation, treated of the attitude of the engineer toward the public. Engineering has grown into a profession that must consider public interests. The practical demonstration of professional ideals lies in the use of fair judgment, a sound sense of justice and quick appreciation of the larger public causes. The engineer not only plans, but carries out, great enterprises. If he be a true member of his profession he will, while serving loyally his employer, keep in mind the honor of his profession, the debt he owes to it and the service to the larger interests of humanity.

Gas Company Loses.

A decision denying the Consolidated Gas Company, of New York city, the right to $4,883,000, was handed down orally on April 15 by Judge Hough, of the United States Circuit Court. These funds are a part of the excess over the eighty-cent rate which has been deposited pending the final decision of this matter. If the money is released, Judge Hough said, the courts would have no power to bring suit for its recovery.

American Electrochemical Society.

The thirteenth general meeting of the American Electrochemical Society will be held in Albany, N. Y., April 30, May 1 and 2. Headquarters will be at the Hotel Ten Eyck, while the sessions will be held both there, in the general lecture room at Union University, Schenectady, and in the lecture room at the Rensselaer Polytechnic Institute, Troy. The following is the programme which has been arranged for this meeting: On Thursday, April 30, a meeting of the board of directors will be held at the Hotel Ten Eyck at 9.30, followed at 10.30 by a general meeting in the ball-room of the hotel, when the following papers will be read and discussed:

"The Construction and Accurate Measurement of Resistances of the Order of 10,000 Megohms," H. L. Bronson.

"The Absorption of the Radioactive Emanations by Cocoanut Charcoal," R. W. Boyle.

"Industrial Applications of Aluminum," E. Blough.

"The Nature of the Surface Film Formed on Aluminum and Magnesium, and the Aluminum-Magnesium Cell," H. T. Barnes and G. W. Shearer.

"Mercury Cathodes in Nitric-Acid Solution," J. A. Wilkinson.

"Copper Anodes in Chloride Solutions," Paul Dushman.

"Solubility Determinations in Aqueous Alcoholic Solutions," A. Seidell.

"The Potential of the Nickel Electrode," E. P. Schoch.

At 2 P. M. the annual business meeting of the society will be held at the same place, the report of the board of directors will be received and the address of the retiring president, Professor C. F. Burgess, will be delivered. The subject of this address is "The Corrosion of Iron from the Electrochemical Standpoint." It will be open for discussion. Following the president's address these papers will be read:

"Electrochemical Corrosion of the Rochester Steel Conduit," Richard H. Gaines.

"The Alloying of Iron and Calcium," A. Hirsch and J. Ashton.

"The Preparation of Calcium Alloys for Aluminothermic Work," O. P. Watts and J. M. Breckenridge.

"Distillation of Turpentine by Electricity," F. T. Snyder.

"Water Power in the Adirondacks and Forest Preservation," E. R. Taylor.

"Power for Electrochemical Industries," J. Meyer.

In the evening a lecture will be delivered by Professor W. D. Bancroft on "The Electrochemistry of Light," in which the lecturer will present a new application of the electrochemical theory. After the lecture there will be an informal gathering in the café of the hotel.

On Friday morning, May 1, a meeting for the reading and discussion of papers will be held in the lecture hall of Union University, Schenectady, at ten o'clock. Electric cars will leave the hotel at Albany at 9 A. M., going direct to the place of meeting. The following papers will be read and discussed:

"Kinetic Molecular Energy," a lecture by C. P. Steinmetz.

"The Heat of Vaporization of Metals and Other Substances," Joseph W. Richards.

"Robert Hare's Electric Furnace," C. A. Doremus.

"Electrochemical Patents," A. B. Marvin, Jr.

"The Electrical Testing of Iron During Annealing," E. E. F. Creighton.

"The Synthesis of Hydrocyanic Acid in the Electric Furnace," R. S. Hutton and E. W. Smith.

In the afternoon a lunch will be tendered the society by the General Electric Company in its restaurant, and at 2 P. M. the shops will be thrown open for inspection. At 5.45 the members will take a train at Union Station for Albany. At 7.30 an informal dinner will be held at the Hotel Ten Eyck, the private dining-room being reserved for this. The price of the dinner will be $1.50.

On Saturday morning, May 2, a meeting will be held in the lecture room of the Rensselaer Polytechnic Institute, Troy, at 9.30. Electric cars leave the Hotel Ten Eyck every few minutes and run to the institute, taking half an hour. The following papers will be read and discussed:

"Conduction in Electrolytes," L. Kahlenberg.

"The Passage of Direct Current Through Electrolytes Without the Use of Electrodes," Carl Hering.

"Reversed Electrolysis," J. W. Turrentine.

"The Conversion of Iron Pyrites, FeS^2, Into a Magnetic Form," O. L. Kowalke.

"The Electrolytic Refining of Iron," E. F. Kern.

"The Electrolytic Corrosion of Aluminum Bronze," W. S. Rowland.

"Further Researches on the Electrolytic Corrosion of the Bronzes," A. T. Lincoln.

"Problems in the Manufacture of Dry Cells," C. F. Burgess.

At 1 P. M. the society will lunch at the Rensselaer Inn, and at 2 P. M. members will visit various points of interest in Troy. This will close the meeting of the society.

ECONOMY AND CLEANLINESS IN PACKINGTOWN – ELECTRICITY AN IMPORTANT FACTOR.

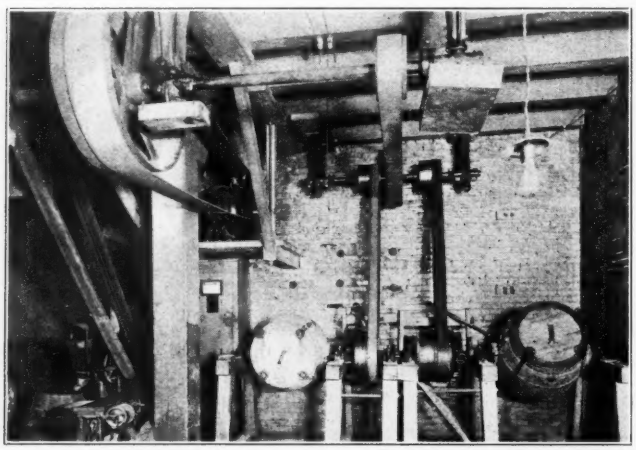
BY C. A. TUPPER.

Whatever may have been the conditions that inspired the writing of "The Jungle," with its plainly exaggerated account of the state of "Packingtown," there is nothing in or about the stockyards of to-day and their manifold industrial plants, teeming with operatives, to even faintly suggest the revolting scenes of filth which Sinclair's lively fantasy pictured. On the contrary, all indoors is the product of an order, good system and cleanliness almost beyond belief, and one of the most potent factors in bringing this about has been the introduction of electric drive, with its consequent clear headroom, freer floor space, better light, ventilation and operating conditions than could ever have been possible under the old system of shafting, belting, pulleys and gears innumerable which formerly stretched in a network across each room, "cluttered up" the place and gathered dirt and waste on every exposed surface.

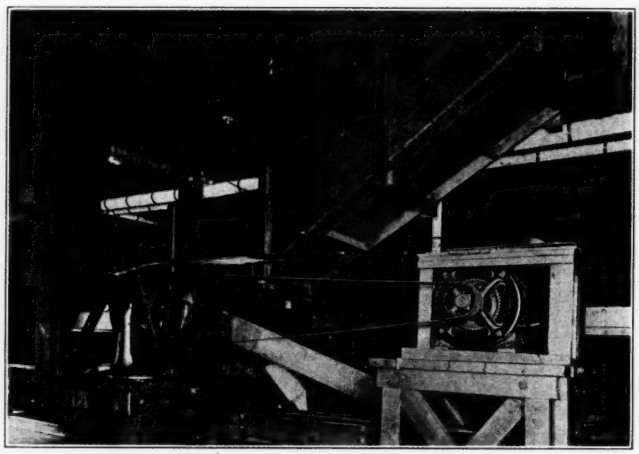
The extent to which motors are now utilized and their widely diversified application was shown in a recent visit of the writer to the various Chicago plants of Swift & Company and Libby, McNeill & Libby, where machines to the capacity of about 9,000 horse-power, in sizes from one horse-power up, are in daily operation.

Strange and queerly named apparatus, which the average man never heard of and probably would not understand, such as rockers, plotters, candlers, crimpers, crutches, neutralizers, etc., are driven by motors on the same current as that supplied to others turning, shaking, or agitating the mixtures in, machines of homely but perfectly intelligible names, to wit: brainers, splitters, cleavers, skinners, strippers, carcass-conveyers, meat-hoists, metal sharpeners, rip-saws, horn-saws, throwouts, etc., in the butcher shop; rippers, cleaners, stuffers, roller-benches, washers, salters, brine-cooler pumps, fan-blowers, spice mills and mixers, sewing machines, etc., in the sausage plant; oil-pumps, mixers, renovators, box churns, suet choppers, salt mills, butter-workers, etc., in the butterine factory; kettle-stirrers, cutters, hashers, presses, mills, oil circulators, molding machines, box nailers, etc., in the soap factory; bone saws, pulverizers, blood presses, driers, washers, compressors, guano crushers, screens, etc., in the fertilizer works; driers, grinders,

reels, etc., in the glue establishment; barrel-headers, hoopers, borers, washers, scourers, etc., in the cooperage plant; paddles, stirrers, etc., in the skin-curing house; cutters, shears, crimpers, etc., in the tin shop; suet choppers, fat cutters and wringers, stearine presses, lard cylinders, screws, agitators, ice crushers, etc., in the lard and stearine factory; wool breakers, driers, dusters, combers, etc., in the wool rooms; pickers, seed grinders, oil presses, tank agitators, oil-pumps, etc., in the cottonseed-oil department, and feather fans, hair driers, etc., in the plants where these products are prepared for market; while hydraulic presses, small pumps of every conceivable description, fans, blowers, elevators, conveyers, separators, hoists and machinery of general utility are electrically operated in all departments and throughout the yards. Then there are the numerous motor-driven tools in the boiler shops, where tanks are made for plants and cars, the woodworking and carpentry shops, machine and general repair shops, and apparatus installed in the coal sheds, power-houses, refrigerating plants, icehouses, warehouses, office buildings, laundries, restaurants and elsewhere —all run by electric power.



FIFTEEN HORSE-POWER INDUCTION MOTOR OPERATING SPICE MILL AND CHURN MIXER IN SAUSAGE FACTORY, SWIFT & COMPANY, CHICAGO, ILL.



INDUCTION MOTOR BELTED TO SUET HASHER, SWIFT & COMPANY, CHICAGO, ILL.

Of all the numerous establishments which have transformed Packingtown from a collection of slaughter-houses into one of the most varied and extensive industrial communities to be met with anywhere in the world, none is more typical of the best modern practice, both mechanically and from a sanitary standpoint, than that of the nine-story "kitchen" of Libby, McNeill & Libby, where the famous canned corned beef, potted tongue, boneless chicken and other delicacies are prepared for shipment to all quarters of the globe.

Meat from the adjoining slaughter-house, after being cut into suitable lengths and thoroughly cleansed, is brought to this building by an elevator (or, if corned beef, lifted from the pickle-curing cellar) and transferred in buckets on trolleys, to the cooking room, which occupies the ninth floor, equal in area to a thousand household kitchens. Here may be seen at a glance the feature which is characteristic of this plant, *viz.:* absolute cleanliness. The walls are faced with pure white enameled brick, the ceilings and floors are of concrete, the window sashes shine with polished metal and there is not a piece of wood either in this or the other rooms to be described.

From the cooking room, meat is sent on enameled conveyers to large white tables in the trimming room on the eighth floor, where it is put in shape for the tins. Flesh representing over 250 cattle can be trimmed here in an hour, with the aid of five meat choppers, each direct-connected to a two-horse-power motor.

The seventh floor is known as the square-canning room, where corned beef is put up. Four stuffing machines, each driven by a five-horse-power motor, and three capping benches, each taking its power from a two-horse-power motor, constitute the principal apparatus used.

On the sixth floor is the round-canning room, filled with stuffing machines and capping benches driven in the same manner as those above described.

Both are supplied with vacuum pans, enabling the cans to be sealed in vacuum, and the six American air-compressor pumps installed for this service in an adjoining room are all driven by belting from one forty-horse-power motor.

The various conveyers used in these rooms have each one one-half-horse-power motor direct-connected.

All of the motors operate on alternating current and are of the "squirrel-cage" induction type built by the Allis-Chalmers Company, of Milwaukee, Wis. These offer especial advantages for the service, as they are simple in construction and are easy to keep clean. The arrangement of each with respect to the machines is plainly shown by the photographs reproduced herewith.

The fourth and fifth floors are devoted to storage rooms, in which may be found the thousands of cans, bottles, jars, glasses, etc., in which the products of the plant are put up.

From the third floor the shipping is done. On the first and second floors are the offices, electric generating plant and refrigerating machines. Here the walls and ceilings, covered with white enamel, throw into sharp contrast the glistening black paint and highly polished steel of the machinery.

All of the stories have numerous windows, and, with the absence of overhead gear of any kind, good light and ventilation are secured, making the entire plant, with apparatus such as that above described, a veritable triumph of sanitation. What part the use of motors plays in this the reader will readily understand. All tables, trucks, instruments, etc., are in keeping with the rest of the establishment, there being nothing that will absorb moisture, and every fixed piece stands on legs high above the floor, enabling the latter to be thoroughly flushed at the close of each day.

A total reaching many hundreds of millions of dollars is realized each year from the sale of packing-house products, including fresh beef, mutton, pork and

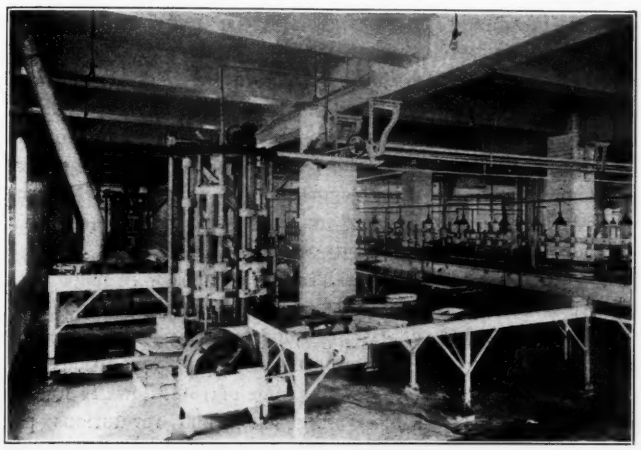
veal, corned beef, tongues, oxtails, hams, bacon, lard, poultry, eggs, butter, butterine, soaps, tallow, glues, oils, bones, fertilizers, pelts, hides, casings, wool, hair, feathers and various other by-products derived from cattle, sheep, hogs and poultry.

The industry is operated on a very narrow margin, and, as there are no secret or complicated processes not open to all, packers such as Swift & Company, Armour & Company and Nelson Morris "waste" into dollars; for, were it not for the so-called "by-products," there would be under present conditions of trade not only scant profit, but an actual loss in the handling of meats from live animals.

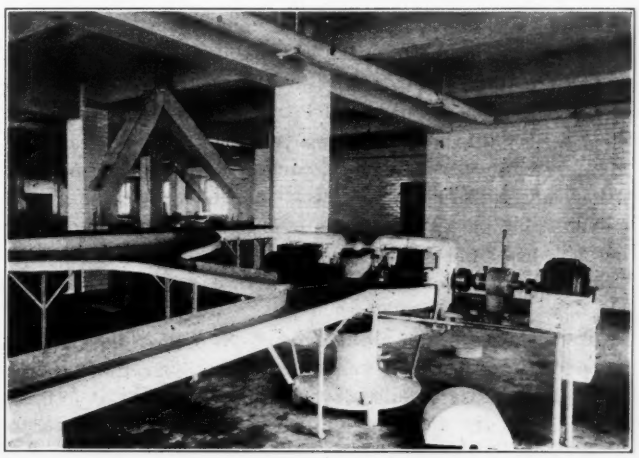
Some years ago the only materials of this kind to which the packer gave any thought were hides and tallow. Other manufacturers in the vicinity, such as glue makers, bought certain parts of the waste; but no really effective utilization of it was made until the meat-men themselves had their attention aroused to the possibilities of this branch of the business.

First they undertook the manufacture of soap, then glue, then fertilizers. Hair, which was formerly thrown away, except for small quantities used by plasterers, is now dried and sold for many purposes. Horns and hoofs form valuable articles of commerce, being used for combs, handles, buttons and ornaments by the score, including excellent imitations of costly materials. Dried blood, ground bone, waste tissues and fibres, when made up into fertilizer mixtures, retail at many dollars the ton. Cartilage and related substances reappear as glue. The choicest of the fats, once indiscriminately classed as tallow, or at best used for lard, form the chief element in making butterine or oleomargarine, and the residue from this fat is refined into stearine, an element of chewing-gum. Other by-products are so familiar that they will readily occur to all.

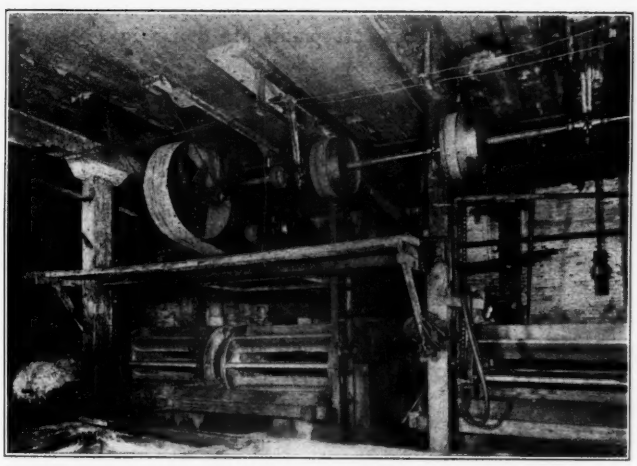
In each process through which any part of the animal passes, until its last vestige has disappeared in the fertilizer house or glue factory, a great deal of mechanism is used, and most of this is capable of being electrically operated. A mere perusal of the long list of motor-driven machines mentioned in the first part of this article will show even a casual reader what the change from mechanical power transmission to motor drive means. So far as economy is concerned, there can be no question that an enormous saving has been effected; and what is true of one great industry may be applied with equal force to others, similarly situated, which have not yet taken full advantage of their opportunities in this respect.



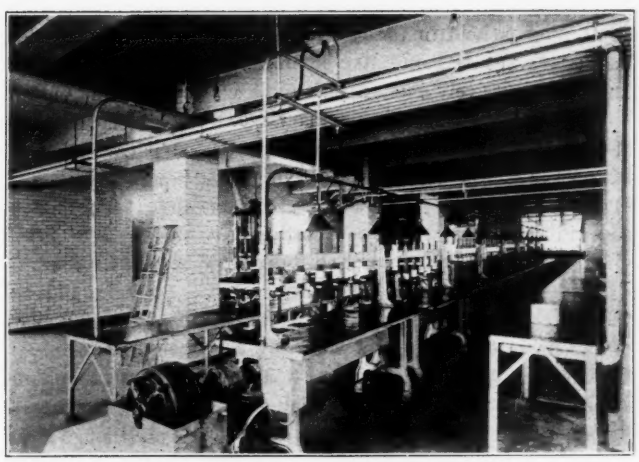
One of Two Seven and One-Half Horse-Power and Four Five-Horse-Power Motors, Direct-Coupled to Stuffing Machines, Libby, McNeill & Libby, Chicago, Ill.



One of Five Two-Horse-Power Induction Motors, Direct-Coupled to Meat Choppers, Libby, McNeill & Libby, Chicago, Ill.



Fifteen Horse-Power Induction Motor Driving Shaft in Sheep-Skin Curing House, Swift & Company, Chicago, Ill.



One of Four Motors Direct-Coupled to Capping Benches, Libby, McNeill & Libby, Chicago, Ill.

Company must depend for their very existence, as large corporate concerns, upon such advantages as location at the chief livestock centres, manufacturing in large quantities at the minimum of expense, good refrigeration, utilization of all "waste" material, and highly efficient business management, including the use of the very best mechanical methods and appliances. It is here that motor-drive has been taken up with such notable results, particularly in the conversion of

HIGH-SPEED ELECTRICAL MACHINERY.[1]

BY GERALD STONEY AND A. H. LAW.

The first high-speed dynamo made for direct coupling to a steam turbine was designed and constructed in 1884 by the Hon. C. A. Parsons. The chief features of interest as described in the patent are those which relate to the provisions to meet the centrifugal forces, the spiral end windings of the drum armature, and the construction of the commutator segments in short lengths dovetailed into steel rings with asbestos insulation.

The armature was two and five-eighths inches in external diameter, and the core, built of very thin iron plate, was two and one-quarter inches in diameter and eight inches long. There were fifty conductors, and at 18,000 revolutions per minute (the normal speed) the output was seventy-five amperes at 100 volts, or ten electrical horse-power.

The surface speed of about 206 feet per second of the armature was a great advance on previous practice, but still more unusual was the speed of alternation of magnetism in the iron of the armature, which in the absence of any but external cooling necessitated the losses in the armature being kept at a minimum.

Internal cooling by means of a flow of oil through a hole in the armature shaft was tried, but was in later plants discarded as relatively ineffective.

Thus at a single step the ordinary speed of dynamos was increased from ten to fifteen times, which ratio it is of interest to note still fairly represents the difference in speed between reciprocating-engine and steam-turbine practice for given sizes of electrical generating plants. Although at this early date in the history of the steam turbine it was naturally the turbine that created most interest, it can safely be said that without the high-speed dynamo—in many ways quite as difficult or even a more difficult problem—there would have been no steam turbine as we know it to-day. It will be easily understood that an entirely new set of mechanical problems had to be faced when it is mentioned that the centrifugal force was about 12,000 times gravity, or in other words, every pound weight had a centrifugal force of about five and one-half tons.

In this early armature the spindle was of high-carbon steel to give the greatest possible strength, the diameter at the centre being one and one-quarter inches, and the bearing one-half inch diameter by three and one-half inches long. The core was smooth, two and one-quarter inches diameter, with notched driving discs of red fibre at each end, and on it was wound a drum-winding with barrel ends, the whole being held together by binding wire to withstand the centrifugal force. The commutator was made up of sections held by dovetailed rings with asbestos insulation. It will be seen that from the first the necessity of long cores of small diameter was recognized, and it is remarkable how closely the magnetic densities, ampere-turns per inch diameter of core, and other electrical quantities agree with what we would now adopt if we were called upon to make a similar dynamo, and this is all the more remarkable as the theory of the dynamo was very imperfectly understood twenty-four years ago, little being known about magnetic densities and still less about hysteresis and eddy currents. The iron available in those days for the core plates had about four times the hysteresis loss of modern armature iron, but this was probably to some extent counterbalanced by the very high periodicities which made the hysteresis losses small in comparison to the eddy-current losses.

These armatures gradually increased in size until in 1889 they reached the size of sixty kilowatts at 6,000 revolutions per minute, the cores being seven inches diameter and eighteen inches long, the output being 600 amperes at 100 volts.

These early types of dynamos were all bipolar with shunt-wound horseshoe magnets. The number of commutator segments were usually twelve for fifty or sixty-five volts, and eighteen for from eighty to 100 volts, and in all but the smallest sizes there was only one complete armature-turn per segment.

In these plants the sparking was not at that time considered excessive at full-load, though it would be considered so according to present practice, but even as early as 1885 it was recognized that it ought to be possible to avoid both sparking and shifting of the brushes by a compensating winding, and such a winding through holes in the cast-iron pole-faces was tried, but the benefit was found to be very small, and it was not gone on with. It is now known that the reason of its want of success was that the ampere-turns of the compensating winding were only about three-quarters of those on the armature and that, had these ampere-turns been trebled, the great improvement effected by the adoption of compensating winding in 1903 would have been accomplished some eighteen years sooner.

In 1889, on account of the temporary loss of the 1884 patent for spiral drum-end connections, an armature was constructed with a series of insulated discs at each end of the core, each connected to opposite conductors, an arrangement identical electrically with the ordinary drum-winding, but although it worked very well the cost and difficulty of manufacture were found to be excessive, and it was decided to adopt a Gramme armature. Besides this, it was early seen that for a given voltage a certain number of commutator segments were necessary and that the sparking to a large degree depended on the ampere-turns in the armature, and since the Gramme armature had twice as many segments as the drum for the same number of conductors it appeared that the result should be better.

Several turbo-dynamos were made with armatures of this type, the most noticeable being some of 400 kilowatts for 500 volts running at 2,200 revolutions per minute, and some of 150 kilowatts for the same voltage at 3,000 revolutions per minute. The former of these sets had two armatures to each machine, these armatures being both mounted on the same spindle with their commutators at opposite ends, and both these and the 150-kilowatt plants are doing good work to-day.

At this time also was introduced the construction of commutator with steel rings shrunk on over mica holding the segments in place against the centrifugal force, a construction which has been universally adopted by all makers of high-speed dynamos. Also, in some cases, fan blades were fitted to these commutator rings for the purpose of both cooling the armature and also the commutator.

The chief defects of these armatures were that sparking was not reduced, owing to the large self-induction of a Gramme winding, and that the heating was excessive, both on account of the difficulties of effective ventilation and also through the heating of the spindle due to its revolving in the stationary internal field of the armature.

For these and other reasons, on the recovery of the patents in 1894 the drum armature was reverted to with considerable improvements in detail, ventilating ducts being provided along the cores to give internal cooling, and the conductors being much more efficiently laminated. And here it may be said that in all these high-speed armatures the cores are

[1] Abstract of a paper read before the Institution of Electrical Engineers of Great Britain.

smooth, or nearly so, and the windings extensively subdivided to prevent eddy currents. Slotted cores for high-speed armatures have been used with some success, but on account of the much higher self-induction of the windings it is impossible to obtain as good results as with the smooth-core type. Slotted-core armatures have been built by C. A. Parsons & Company on several occasions, but results were never obtained which could in any way compare with those given by smooth, or nearly smooth, cores.

In some of the most recently built armatures of large size the conductors have been laid in slight grooves in the core. These grooves provide a means of preventing the conductors from moving, and the iron between the conductors reduces the reluctance of the air-gap to some extent. The conductors are held to the core by binding wire made of steel piano wire, a material which long experience has shown to combine the qualities of reliability and high tensile strength, which render it immensely superior to such material as phosphor bronze. Its magnetic properties are its one defect, but careful tests have shown that these are relatively of minor importance.

A series of experiments made about 1887 showed that in small turbo-dynamos of twelve to sixteen kilowatts, running at speeds of from 8,000 to 9,000 revolutions per minute, giving periodicities as high as 130 to 150, the saving in power obtained by using phosphor bronze instead of steel wire amounted to only about two per cent, and a further series of experiments conducted in 1904 on two 150-kilowatt armatures at 3,600 revolutions per minute showed a saving in power of less than 0.30 per cent by using phosphor-bronze wire, and it is still less in larger armatures.

Against this saving must be set the fact that phosphor bronze has much lower tensile strength, and therefore a larger quantity is required. Also bronze wire is liable to have occasional soft spots of weaker material, which is a fatal defect, and it is a matter of experience that steel binding wire, when properly applied, is extremely reliable. Further, the surface construction enables the insulation of the conductors to be carried out in a very complete manner, so that there is no danger of insulation being cut locally by sharp corners or projections from the core plates.

In all these earlier dynamos the magnets were of the ordinary type, generally horse-shoe; but even when the size was limited to 200 kilowatts at 3,000 revolutions per minute, although the commutation was good when the brushes were properly set for the load, heavy sparking was experienced on large variations of load, such as is met with in the case of traction plants.

The first method of meeting the difficulty was to shift automatically the brushes according to the load, this being effected by moving the brush rocker by a piston controlled by a spring and actuated by the steam pressure at the inlet to the turbine. The angular movement required by the brush rocker is approximately proportional to the load, and the pressure at the inlet to a turbine is also proportional to the load, so that it is easy to arrange for the brushes to be shifted the right amount. This arrangement, however, had the defect that it was not rapid enough to meet sudden and large changes of load, and under such circumstances some sparking occurred during the interval of lag.

In the year 1891 Professor Forbes took out a patent for a special winding to prevent distortion of the magnetic field in homopolar dynamos. The primary object of this patent is stated to be the correction of distortion in homopolar machines, but the patent is also extended to other classes of dynamo electric machinery.

In Professor Forbes' arrangement the current passed along one pole in a direction opposite to the direction of the current in the armature under that pole, and back along the other pole. In the early Parsons arrangement of 1885 what corresponds to a ring winding was used, the active wires being embedded in the pole-face, while the return was made at the back of the poles.

The Forbes' specification definitely states that the number of wires on the polar faces is half the number on adjacent parts of the armature, and this gives a number of ampere-turns in the compensating winding equal to the ampere-turns of the armature, and the want of sufficient ampere-turns was the reason why the arrangement did not yield the remarkable results obtained in later years.

In 1903, after a series of experiments, C. A. Parsons & Company constructed a 300-kilowatt, two-pole compensated dynamo working at 3,000 revolutions per minute at a voltage of 500, in which the ratio of compensating ampere-turns to armature ampere-turns were as high as 2.4. The armature dimensions (with the exception of the commutator, which was, of course, larger) were similar to the standard 200-kilowatt plant of that date, and at once remarkable results were obtained, since it could be loaded up to 800 kilowatts, and when that, and even greater loads, were thrown on and off with a circuit-breaker, there was no need to alter the position of the brushes nor any excessive sparking.

This type of compensating winding is now being exclusively used by the above firm, with modifications of detail only, on all their continuous-current turbo-generators. As this compensating winding, which generally is chiefly concentrated on the pole-pieces, is made with from two to two and one-half times the number of ampere-turns that are on the armature, there is a very large excess, sufficient both to neutralize the distorting effect of the armature windings on the field and at the same time to provide a commutating field for reversing, without sparking, the current in the coil undergoing commutation. Owing to the width of this field the brushes need not be so accurately set, and there is considerable range of sparkless commutation at all loads.

Since this method of compensating has no iron commutating pole, it has the advantage that there is no self-induction to cause time lag at sudden changes of load; as the field in the gap between the poles is entirely in air, it instantly responds to changes of current in the compensating winding, and thus the sparking often seen when there is a sudden change of load with commutating poles is avoided and the risk of a flash-over largely reduced. Also, since there is no iron to become saturated, the commutating field is always strictly proportional to the load, and thus the trouble due to saturation causing sparking at some loads and not at others is avoided. This advantage is felt still more when the dynamo is required to give varying voltages and to commutate well at any of them without any adjustment of the compensating winding by diverters or otherwise.

The advantages of a compensating winding are much more than those due to fixed brushes and better commutation, since it has enabled not only the number of segments for any given voltage to be reduced, but also the ampere-turns on a given diameter of armature to be increased. This enables a larger output to be obtained for a given speed, or what is the same thing, a higher speed to be used for a given output. Before compensating was adopted, 500 kilowatts at 1,800 revolutions per minute was the extreme limit

of size for that speed, and the machine would not carry more than ten per cent overload. Now we have made a 500-kilowatt running at 3,000 revolutions per minute, or a 750-kilowatt running at 1,800 revolutions per minute, carrying twenty-five or thirty per cent overload without sparking, and fifty per cent for a short time without injurious sparking. This has enabled not only the cost of the turbine to be largely reduced, but also the steam consumption to be lowered by some ten per cent.

No difficulty has been experienced in running these compensated dynamos in parallel with one another or with other types, although in all cases they are self-exciting, no separate exciter being used.

We have found brass-wire brushes running on a grooved commutator to give the best results. The grooving has the advantage of increasing the surface of contact, and of allowing the brush to better follow the irregularities of the commutator.

The first turbo-alternators made were for the Newcastle and District Electric Lighting Company, Limited, four seventy-five-kilowatt sets being installed in 1889 in their Forth Banks station. They generated single-phase current at 1,000 volts, and being two-pole on a supply at eighty cycles, ran at 4,800 revolutions per minute. They were of the revolving armature type, and had a smooth core seven and one-half inches in diameter by thirty inches long, with a single shuttle winding held on by binding wire, the ends being brought to slip rings. External or surface ventilation was solely relied upon for the dissipation of heat. These early alternators ran quite satisfactorily for about fifteen years, when they were removed to make room for larger units.

A considerable number of turbo-alternators of 150 kilowatts at 4,800 revolutions were made for the electric supply stations in Newcastle, Cambridge, Scarborough and other places, having cores eight and one-quarter inches in diameter and thirty-two inches long. As it was seen, however, that in the larger alternators more surface for the dissipation of heat would have to be provided than that presented by the exterior of the armature alone, a square four-inch spindle was employed with radial ducts and holes through the winding to pass air for cooling. Many of these machines which were made between 1891 and 1894 are still running and doing good work.

In 1894 the first of a series of 350-kilowatt turbo-alternators were made for the Manchester Square Station of the Metropolitan Electric Supply Company. These supplied single-phase current at 1,000 volts, and had four-pole revolving armatures running at 3,000 revolutions per minute, giving 100 cycles. Their cores were seventeen and one-half inches in diameter by fifty-seven inches long, and were provided with twelve one and one-quarter-inch holes passing the whole length of the armature, air being drawn through by a fan, though no radial cooling was provided. The first few were surface-wound, but owing chiefly to the eddy currents developed in the conductors, which were large and insufficiently laminated, there was considerable trouble from heating, and they were subsequently altered to a tunnel winding with sixty holes three-quarters inch in diameter, forty of which were filled each with one conductor, the remaining twenty holes being empty, since the alternator was single-phase. This type of alternator was very satisfactory for single-phase work, the largest made being of 1,000 kilowatts for the city of Eberfeld, in Germany. The armature core was thirty-six inches in diameter by forty-eight inches long, and the machine ran at 1,500 revolutions, giving 4,000 volts at fifty cycles.

Two and three-phase alternators were also made on the same lines up to 500 kilowatts at 500 volts, and even 2,000 volts, the most noticeable of this type being the two 1,500-kilowatt, two-phase, 2,000-volt plants, which were installed in 1904 at the Neepsend station of the Sheffield Corporation, and have run ever since without giving any trouble.

The crossing of the windings at the ends, however, makes the problem of a revolving polyphase armature much more difficult, especially at high voltages, though, on the other hand, the iron loss, especially in two-pole plants, is only about one-third of what it is with a revolving field. The real trouble came when it was attempted to make a 1,500-kilowatt, forty-periodicity, four-pole, three-phase alternator, with a revolving armature running at 1,200 revolutions per minute, and a voltage of 6,000. It was found impossible to insulate sufficiently the end windings and at the same time get rid of the heat generated, and as a result the modern type of revolving field was adopted.

In revolving-field high-speed alternators of various constructions there is comparatively little difference in the design of the stationary or high-tension element. This follows low-speed practice fairly closely, though the external appearance is widely different, owing to the few poles, small diameters and greater length of the high-speed plant. It has, however, been found necessary to introduce a special system of brackets or clamping rings to hold the end windings against the enormous forces developed in case of a short-circuit or other serious disturbance on a system. In the case of several alternators running in parallel these forces may be so great that every precaution must be taken to prevent movement of the coils, and no make of turbo-alternators has been free from trouble from this cause, though in our recent designs the coils are so stayed as to be proof against the most severe short-circuits.

The 4,000-kilowatt, three-phase alternators at 6,000 volts installed at Carville power station are split along the horizontal diameter and so arranged that the top half can be lifted by breaking only four electrical joints. This construction has the advantage for plants of large size that the rotor can be lifted out direct, but it rather complicates the end windings. The plant illustrated is capable of carrying 6,000 kilowatts for two hours, and on its official trial was loaded for half an hour up to 7,000 kilowatts.

There are under construction at the present time two 5,000-kilowatt alternators for 6,000 volts at 750 revolutions per minute of this type for the Sydney tramways. These plants are guaranteed to do 6,250 kilowatts continuously, 7,500 kilowatts for two hours, and to have a temperature rise not exceeding forty-five degrees Fahrenheit when run continuously at full load.

It is in the rotors of high-speed alternators that the greatest diversities of design are to be found. A great deal has been said as to the relative merits of salient pole as compared with cylindrical-type rotors, especially as regards the voltage regulation of the alternators, some designers advocating the former as strongly as others support the latter, but it appears that a much more important question is whether one design shows marked advantages mechanically over the other. Any difference there may be in the two types as regards voltage regulation is certainly small, and can easily be compensated for at small expense by other features in the design.

A large number of alternators of the salient-pole type are in successful operation, and though in the early days there were mechanical troubles caused by the coils moving and chafing the insulation, modern methods of construction have

quite done away with this source of trouble.

The question of ventilation is of very great importance in modern high-speed plant, owing to the compact nature of the machines, which is a result of the limit placed on the diameter of the revolving portions by the high speeds of revolution, and in consequence it becomes necessary to make the maximum possible use of the space in the rotor which is at the designer's disposal.

The material which has to be got into this space may be classified as follows:

1. Iron to carry the required flux.
2. Copper to carry the required magnetizing current, with the necessary insulation.
3. Area to carry air ventilation.
4. Materials included for mechanical purposes only.

The correct proportioning of these various parts with a view to a maximum of effectiveness and a minimum of cost, both for labor and material, is the problem that the designer has to face. The output of a given design may be regarded as directly proportional to the first of these, namely, the iron, and nearly proportional to the second, the copper, so that if these can be increased at the expense of 3 and 4 a valuable saving may result. This has been effected in many cases by providing artificial ventilation for cooling the iron and copper of the stationary element. The ventilation scheme which some makers have adopted is to provide a centrifugal fan at each end of the rotating element, or to make the rotor itself create the draft. Thus air is driven both round the end windings of the stator and also through the ducts in the iron core, and out through a chimney at the top of the stator casing. In other cases a separately driven fan is provided, forcing air through both the stator and rotor of the alternator. In both these methods, or a combination of them, the extra pressure obtained results in the passing through the generators of large quantities of air, which is often arranged to be drawn from outside the building, so as to be as cold as possible, thus largely reducing the final temperature of the windings.

Among other stations, the Carville power station of the Newcastle-upon-Tyne Electric Supply Company, Limited, has a ventilation scheme with separately driven fans which were installed to enable the alternators to carry heavier overloads, although in the first instance the machines were run for some years with natural ventilation, and were well inside the figures guaranteed for temperature rise.

C. A. Parsons & Company have constructed two, four and six-pole rotors of the salient-pole type.

In the smaller two-pole and four-pole designs a solid construction with the coils wound in place is adopted. The two-pole rotor is thus very similar in appearance to the old Siemens shuttle or H-type armature, with which many of us must have been familiar in the early days of electric lighting. The formation is excellent mechanically, since there are few loose parts, and the solidity of the construction enables great mechanical strength to be secured. The rotor body is bored at each end and shaft ends of special high-tensile steel forced in, and then the whole turned up and accurately balanced. The balancing is done in three stages before winding the coils:

1. By insuring static balance on a pair of carefully leveled knife edges.
2. By careful measurement.
3. By running up to about one-third above normal speed in a specially constructed balancing machine.

The combination of these three methods is essential, since while the balance may be perfect on the knife edges, this may be the result of one end of the rotor being heavy at one side, while the other end is heavy on the other. In this case, though in perfect balance on the knife edges, there will be present when running a powerful couple traveling round at the same speed as the rotor and causing vibration. Careful measurement will generally show where weight should be removed or added to give both good static and dynamic balance, which is corrected and improved by actually running and fitting weights as required.

The rotor, after being thus balanced, is put into a horizontal winding machine, and the coils wound into coil cases, which are made of tinned steel and completely soldered up after the winding is completed. The ends of the coil are brought out through a brass lip, soldered into the case, and fitting tightly round the connection to the next coil or to the slip rings, thus making a hermetically sealed coil. Up to the date of writing there has not been a single case among a large number of machines of a coil wound on this system becoming earthed or giving trouble in any way.

A further advantage of coils thus wound and protected is the permanence of the balance of such rotors. Formerly with unprotected coils the windings had to find their own place as they were squeezed up by the centrifugal force, by the sliding of the insulation along metal surfaces more or less smooth. Thus the insulation was sometimes damaged and perhaps one or two coils went further up than others, thus throwing the rotor out of balance. On running again other coils would move slightly, and so the balancing process had often to be repeated several times before a stable condition was reached. With the metal cases the coils take up their final position at once and stay there, and it is a common occurrence for a rotor to go straight up to twenty-five per cent over speed the first time it is turned round without requiring any further balancing. In the case of large rotors the pole-tips are made to slide over a tee-shaped projection on the rotor body, and the coils are wound separately in coil cases and slipped over the poles before the pole-tips are put on.

In selecting material for high-speed work it is particularly necessary that it should be of the best, and it is most desirable not to obtain high tensile strengths at the expense of the ductility of the material; it is rather tempting to do this, since a design can often be materially improved and cheapened by using a large diameter and high peripheral speed, while the factors of safety can be kept high, on paper, by using such material, but it is on the ductility that we rely for properly distributing the stresses between the various parts, while material of too great hardness may easily be cracked or flawed accidentally either during construction or afterward.

As in the case of continuous-current machinery, one object is to get the maximum output at the highest speed possible. The strengths of the materials limit the diameter and length of the rotor and therefore both the available flux and ampere-turns. This again limits in the stator the output for a certain inherent regulation. If, however, any method of compounding the alternator to improve the regulation is adopted, much larger outputs can be obtained from a given carcase. Many methods of doing this have been proposed, but most of them depend on either commutating a portion of the alternating current or causing certain parts to become saturated as the load increases, or by varying the effective resistance of the winding on the exciter magnets. The first is objectionable on account of the trouble given by commutators, the second since the compounding will vary with varying voltage, and the third is generally too slow to allow for rapid changes of load.

A method of compounding has recently been brought out which avoids these difficulties. The exciter is provided with an alternative path for the magnetism in parallel with the armature which we call a "leakage path." This "leakage path" is provided with a winding, which is in series with the stator winding, and as the alternating current in this rises it chokes back the magnetism, or in other words increases the magnetic resistance of the leakage path. Thus more flux goes through the armature and therefore the voltage of the exciter rises and compensates for the tendency of the main voltage to drop. In a three-phase alternator there is generally one leakage path in each phase, and if the primary current is at high voltage, a current transformer is generally used. These leakage paths are easily adjusted for any desired amount of compounding, or for any power-factor.

BOOK REVIEWS.

"Le Catalogue International des Principales Publications Periodeques." du Monde. Emile Guarini. Paris. H. Dunod & E. Pinat. Paper. 76 pages. 6¼ by 9½ inches. Price, 3 francs.

Professor Guarini has performed an acceptable service in preparing this catalogue of the principal journals of the world. He has classified them primarily under countries, and secondarily according as they are devoted to bibliography, theological, philosophical and social science, commerce, industry, medicine, and the exact sciences; arts and literature; geography and history; and general reviews, sports, etc. Following the title of each journal is the name of the publisher, the city where published, the year during which it was founded—when this is known—the number of times it appears during the year, whether illustrated or not, and an indication of character of the paper used and the subscription price. A useful table, showing the relative value of kinds of money, enables any one to determine the cost of the journal. The list contains 4,063 journals. It is to be regretted that the addresses for the journals published in the United States are defective in that the city, but not the state, is given. However, as most journals are published in well-known cities, this defect is not as serious as it might be.

"Le Perou d'Anjour d'hui et le Peron de Demain." Emile Guarini. Paris. H. Dunod & E. Pinat. Paper. 16 pages. 6¼ by 9½ inches. Price, 2 francs.

Professor Guarini gives here an interesting summary of the industrial conditions in Peru at the present day and an idea of what he expects to be the conditions a few years hence. In this he naturally expects that electric power will play a leading part and he gives brief statements of the various industries which may be expected to be built up in Peru by means of this agency.

"Fowler's Electrical Engineer's Pocketbook." William H. Fowler. Manchester. Scientific Publishing Company. Boards. 680 pages. Illustrated. 4 by 6 inches. Price, 1/6 net; with superior binding and gilt edges, 2/6.

In the 1908 edition of this convenient little handbook it has been necessary to rearrange the matter somewhat and to eliminate a part of the old material in order to make room for the new. Advantage has been taken of this to rearrange the contents in sections under distinctive heads, which aid considerably in quickly finding the subject matter desired. The increasing use of electrical apparatus demanding discussion has forced the editor to adopt the policy of limiting the handbook largely to purely electrical matters and to cut out all the mechanical matter which is not essential. The book covers the usual ground, containing mathematical and physical tables, brief discussions of elementary electric phenomena and laws, and sections devoted to the different branches of the industry.

"Handbook for the Care and Operation of Naval Machinery." H. C. Dinger. New York. D. Van Nostrand Company. Cloth. 302 pages. Illustrated. 5 by 6½ inches. Furnished by the ELECTRICAL REVIEW for $2.

This book has been compiled by Lieutenant Dinger from a series of articles published in the Journal of the American Society of Naval Engineers, the information in it being based upon the experience of the operating force of the Bureau of Steam Engineering. It is devoted almost entirely to a discussion of the care of the steam equipment, and is arranged so as to make reference easy in case of trouble. The few electrical devices considered are merely auxiliaries in the operation of the steam equipment such as ship telegraphs, controllers for auxiliary motors, etc. The volume contains a great deal of helpful information to those responsible for the operation of steam plants.

"Technological Dictionary in French, German and English." Alexander Tolhausen. Revised by Louis Tolhausen. Vol. i, 810 pages plus 198 pages, French, German and English. Vol. ii, 828 pages plus 190 pages. English, German and French. Vol. iii, 948 pages plus 78 pages, German, English and French. New York. The Macmillan Company. Cloth. 5 by 7 inches. Price, $2.75 for each volume.

This well-known dictionary is one of the most complete technical dictionaries of the French, German and English languages. Each volume has a large supplement in which are included the modern terms and expressions employed in electrical engineering. While these, as a whole, are satisfactory, in some cases the English terms are not those in use in this country, and occasionally a common technical term can not be found in the supplement, though it may be found as a translation of the corresponding foreign term. On the other hand, the bringing together of the technical terms in the supplements lightens the labor of the one using the dictionary to translate electrical articles.

"Electrical Railroading." Sidney Alymer-Small. Chicago. Frederick J. Drake & Company. Flexible leather. 924 pages. Illustrated. 5 by 7 inches. Furnished by the ELECTRICAL REVIEW for $3.50.

The treatment adopted in this book is catechistical, as the author believes that in this way the attention of the student is directed to the particular point under discussion. He assumes no knowledge at all of electrical matters, and devotes the first eighty pages to a discussion of elementary phenomena of static electricity. The object of this is to lead up to an understanding of the functions of lightning arresters, to which subject the following sixty-six pages are devoted. This arrangement is rather unusual, as an understanding of the vagaries of lightning taxes the knowledge of the most expert electrician. Magnetism is next taken up in the same way, starting at the very bottom and building up until the modern idea of the magnetic circuit and magnetism in iron is explained. Current electricity follows next, beginning with primary batteries, the various common types of which are described, as well as the method of caring for them. Secondary batteries are then taken up, though somewhat briefly for this rather important subject. A brief discussion of electrolysis follows, and then the electric circuit is discussed, the laws of electric flow being explained, and the various types of instruments employed for measuring electrical quantities described. After touching briefly upon alternating and direct currents, the action of the transformer is explained, followed by a discussion of various types of dynamos and the methods employed in constructing them. So far the treatment has been preliminary and has taken up about half of the book. From here on the discussion is limited more strictly to electric railroading, beginning with a description of railway motors and generators, and a discussion of the power-house equipment and methods of operation. In every case the author goes at some length into the details of the equipment. Transmission lines and working conductors are next discussed, followed by a comparison of steam and electric traction. Then the various systems of control are described, including all of the well-known types of equipment for both the single-car and multiple-unit control. It will be seen that the book covers a large field in an elementary way, but, so far as it goes, the explanations are fairly well given. They are clear, and the student should have no difficulty in understanding them. While the greater part of the information is given, as has been said, by question and answer, each subject is introduced by a brief discussion of the ground to be covered, the object of the various devices to be described, and the principles upon which they operate. This method saves a great deal of space and enables the author to limit his questions generally to such subjects as might be expected to come up in every-day work. This method of treatment is almost entirely employed in the descriptive part of the book. As will be gathered from what has been said, the book is intended more for the operating man than for the engineer.

THE DYNAMOPHONE.

BY H. GERNSBACK.

While conducting some experiments in wireless telephony I made the discovery of quite an interesting combination which, to my knowledge of the art, has not been tried up to this date.

To produce mechanical effects directly, man is obliged to exert his muscular forces, by bringing his muscles in contact with the object to be moved, or through an indirect way, namely, by interposing a tool between the muscle and the object. This tool might be a lever or it might be a telegraph key, which latter, if desired, will move or disturb the far-off object through another medium, electricity.

To apply power to an object the hand is used more than any other part of the human body; the foot probably ranges next. The whole body, mostly applied as a lever, follows. The head is practically never used at all. The lungs are used very little comparatively, for instance in glass blowing, etc.

The voice has never been used, no case being on record that a motor or a dynamo was started solely by talking, to or through a medium. I am, of course, well aware that by talking in a transmitter the telephone diaphragm at the other end will vibrate, but that can hardly be called power, it being proved that in most cases the vibrations of a receiver diaphragm measure less than one-five-thousandths of an inch. To provide a contact on the diaphragm in order that the vibrations should close a certain circuit, which in turn could be relayed, to transmit or start power, has always proved a failure on account of the vibrations of the diaphragm, created by the human voice, being exceedingly weak.

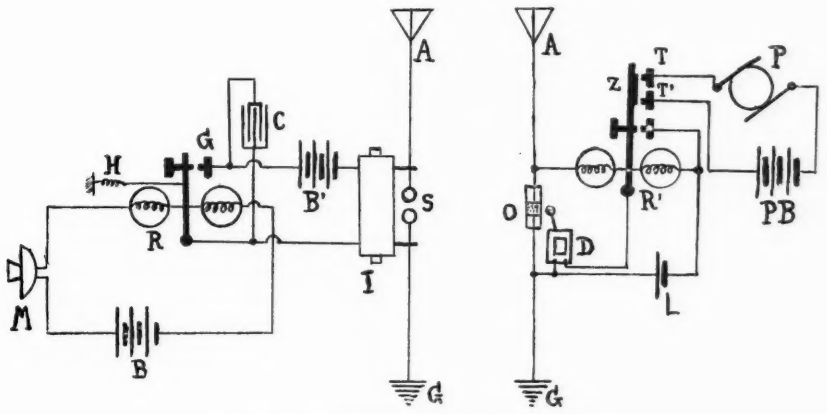
My arrangement, as described below, to transmit or start power, etc., simply by talking into a transmitter, will therefore be found novel, especially if it is considered that the transmitter is not connected with the receiving station whatsoever. The transmission is made by means of wireless electric radiations.

No new apparatus being needed in my arrangement, any amateur can easily perform the experiment.

Referring to plan, M represents the common transmitter as used on most telephones. R is a fairly sensitive pony relay of seventy-five ohms. C is a condenser to absorb excessive sparking; L, induction coil; S, oscillator balls.

The tension of the adjusting spring H on the relay should be just sufficient to keep the armature away from contact G. With a little experimenting the right tension will be ascertained.

By talking medium loud in the transmitter, the resistance in same will be varied accordingly and the armature will close the circuit at G, through battery B′ and coil I, which may be a common one-inch spark-coil not deprived of its vibrator.



ARRANGEMENT OF "DYNAMOPHONE" CIRCUIT.

Every time the circuit is closed at G a series of sparks will jump across the balls at S, creating oscillations. These oscillations, traveling through the ether, arrive at the receiving station, where they impinge on the antennæ A and operate the coherer O through relay R′. The decoherer D is also shown. Relay, coherer and decoherer are all operated by a single dry cell L. This is the same circuit as in my "Telimco" wireless system. Relay R′ has in addition two stationary contacts T and T′, which, when the armature Z closes, complete another circuit, as, for instance, through a small motor P, an incandescent light, etc.

As long as words are spoken in the transmitter M, oscillations will be set up in S and the receiving station will work continuously until the voice at M stops. Motor P will, of course, be kept in motion only as long as the voice talks into M.

Control of Platinum.

Russia, the chief source of supply of platinum, producing annually over 210,000 ounces, troy, is about to attempt to rehabilitate market prices, which became weak by reason of the peculiar conditions in the United States some months ago, says the *Mining World*.

The United States imported last year 73,608 ounces, valued at $2,509,926, most of which was produced in the Ural Mountains in Russia. Foreign advices state that the powerful Compagnie Industrielle du Platine will increase its share capital from 16,000,000 francs to 20,000,000 francs ($3,088,000 to $3,860,000). With the $772,000 new capital it is intended to purchase additional platinum properties and obtain control of an important London firm which is largely interested in the Ural industry.

The Compagnie Industrielle du Platine is undoubtedly the leading producer of platinum, and having extensive refining works in Paris, forms the connecting link between certain independent producers and the syndicate of buyers which is headed by Johnson, Matthey & Company, of London.

Should it so happen that the Compagnie Industrielle du Platine is successful in its important negotiations, American consumers, who are among the largest in the world, may expect higher prices. At present ordinary platinum is worth $24 to $24.50 per ounce and hard metal $26 to $26.50 f.o.b. New York. Last year quotations were up to $38 for ordinary platinum and $41 for hard metal—prices which were the highest in a number of years. Even at the current lower prices platinum is worth more than gold.

While those who control the Russian industry are striving to improve the metal market, there is the prospect of an increased production in the United States. Aside from the supply from the placers of California, Oregon, Washington and Alaska, platinum has been observed in certain copper-nickel ores in southwestern Utah and in eastern Nevada. The annual output of platinum in this country is now not far from 1,500 ounces, whereas in 1902 it was only ninety-four ounces.

Other sources of supply of platinum include Colombia and British Columbia. There have been discoveries in South Africa and certain other countries; but speaking generally there are none so extensive as the mines in the Urals.

Ontario Hydroelectric Power Commission.

At a conference in Toronto, Ontario, on April 3, between the Hon. Adam Beck, the Ontario Hydroelectric Power Commission and representatives of fourteen municipalities, a draft of the contract under which power will be supplied by the commission was presented.

According to the contract submitted, the commission agrees to construct a line for transmission from the falls to the corporations. At the expiration of three months' written notice the commission agrees to supply to the corporations a proportion of the power asked for, and at the expiration of nine months' notice to supply additional power up to 100,000 horse-power. The commission contracts to use the most modern plant and do everything possible to secure the very best service to the respective consumers.

The agreements on the part of the corporations are to pay the commission for the power used, in monthly payments, "in gold coin." If the payments are not paid promptly, the service may be discontinued.

To pay annually interest at four per cent on moneys expended by the commission on capital account for construction of said line.

To pay a sum to form in thirty years a sinking fund for the retirement of the securities to be issued by Ontario, for the payments of the cost of the construction of the said line.

To pay the line loss and cost of operation and maintenance.

To pay for three-fourths of the power supplied and held in reserve, whether power is taken or not.

To use the most modern apparatus and supply skilled labor to secure the best results, and to take such power exclusively from the commission.

Unless determined as provided in said contracts this agreement to remain in force for forty years.

The power to be three-phase alternating commercially continuous twenty-four-hour power every day of the year, except this be prevented by strike, lockout, riot, fire, etc.

Ascertained damages to be paid by commission in case of interruption, except as above.

The commission's engineers always to have the right to inspect.

The schedule places Toronto at 10,000 horse-power, and estimates minimum cost of power ready for distribution at $18.10.

The agreement entered into between the Hydroelectric Power Commission and the Ontario Power Company has now been made public. The contract is signed by the Honorable Messrs. Beck and Hendrie and W. K. McNaught, on behalf of the commission, and by J. J. Albright and Robert C. Board, president and secretary of the Ontario Power Company, respectively. The contract is to become binding on the commission on passage of an order-in-council by the government. The company will commence to deliver 8,000 horse-power of electricity to the commission at the expiration of ninety days' notice. At the expiration of three months' notice it will deliver in blocks of 1,000 horse-power energy up to 30,000 horse-power, and on nine months' notice electricity up to 100,000 horse-power. The commission agrees to take power exclusively from the company up to 30,000 horse-power, and also one-half of the amount of power required by the commission up to 100,000 horse-power, after which the commission may take electricity from other sources. The company, on its part, will not deliver power to any person that it is intended shall be supplied by the commission. The commission agrees that it will not supply power of less than 60,000 volts at a price less than the price provided in the contract, with the cost of transforming added thereto, in the territory supplied by the transmission lines of the company.

The commission must pay three-fourths of the power ordered, whether it takes it or not, at the prices already announced.

The agreement is to remain in force for ten years, and is subject to renewal for ten-year periods. It is not, in any event, to go beyond 1950. The company agrees not to exercise its right to cancel its charter during the continuance of the agreement. If, after all reasonable diligence, the commission is not within eighteen months able to start to take power, the company shall have the right to cancel the contract.

Penalty clauses are inserted providing for a reduction in case of an interruption of the service. In case any municipality or its customers for power shall suffer damages, the commission shall be entitled to commence proceedings for damages. Provision is made for arbitration of any disputes which may arise between the parties as to the performance of the terms of the agreement.

If the quantity of power being taken by the commission shall amount to sixty per cent of the total development of the company and a complaint is made in writing that the company is continuously neglecting to fulfil its agreement, the lieutenant-governor-in-council by order may, on reasonable terms, transfer the entire plant and property to the Hydroelectric Power Commission.

THE CONVERSION OF DIAMOND INTO COKE IN HIGH VACUUM BY CATHODE RAYS.[1]

BY CHARLES A. PARSONS AND ALAN A. CAMPBELL SWINTON.

The objects of the experiment were threefold: firstly, to ascertain whether a diamond could be entirely converted into coke or graphite by heating in a vacuum by cathode rays; secondly, in the event of this being found practicable, to make a determination by Féry's optical pyrometer of the temperature at which the conversion takes place; thirdly, to endeavor to ascertain if, during the conversion, any gas was emitted or absorbed by the carbon.

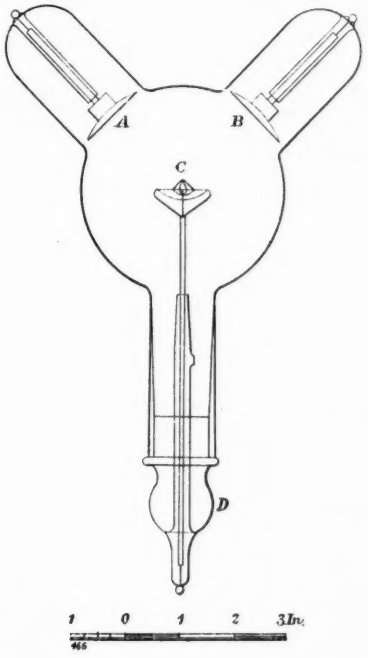
The vacuum tube employed is shown in the illustration, where A and B are the two aluminum electrodes, C the diamond, and D an air-tight ground-glass stopper joint, through which the diamonds were introduced. Alternating current was employed, each of A and B acting as cathode and anode in turn, while their concave curvature was such as to accurately focus the cathode rays onto the diamond. The latter was supported on a plate of iridium, which, in turn, rested in a platinum cup, this arrangement being designed to prevent any stray cathode rays which might miss the diamond from striking the glass walls of the tube and melting the latter. During the experiment the tube was connected to two mercury pumps of the Toepler type, and in connection with the tube there were also attached two spectrum analysis discharge tubes for the purpose of collecting and examining some of the residual gas in the tube, both before and after the conversion of the diamond into coke.

The alternating current from the mains, which was of eighty-five periods per second, was passed through the primary of a ten-inch Rhumkorff coil, with the contact breaker and condenser disconnected, with an adjustable choking-coil in series in the primary circuit, so that the secondary voltage could be varied from about 5,000 to 12,000 volts. A reflecting milliampere-meter was employed to read the current through the tube, while the volts across the tube's terminals were measured by an electrostatic voltmeter.

Two diamonds, each about 0.2 inch in diameter, were experimented with. The first was entirely converted into coke without difficulty, while in the case of the second the process was stopped when most of it had been so converted, the residue being black throughout its mass. As the proper degree of vacuum was reached by

[1] Paper read before the Royal Society of London.

working the mercury pumps, and as the volts were raised, the diamond in each case became red, and then intensely white hot, till with about 8,000 volts and forty-four milliamperes (352 watts) passing through the tube the diamond began to throw off small sparks. On the volts being increased to 9,600 and the current rising to 45.5 milliamperes (436 watts), the sparks thrown off became more numerous and the diamond commenced to become black. Finally, with 11,200 volts and forty-eight milliamperes (537 watts), a rapid disintegration of the diamond took place, with considerable increase in volume, the residue having much the appearance and consistency of coke. The temperature of the diamond, as given by



VACUUM TUBE EMPLOYED IN CARBONIZATION OF DIAMOND.

the pyrometer, during disintegration was 1,890 degrees centigrade.

During the heating up of the diamond and of the tube, large amounts of gas were driven off and had to be pumped out, but there was nothing to indicate that any of this gas originated from the diamond rather than from the metal parts and glass walls of the tube. Two experiments were made, and in the latter there was distinct indication of a rise in vacuum just about the time of the conversion. These rises in vacuum are, however, not unusual in tubes in which there is highly heated metal, and it was impossible to decide whether any of the absorption of gas took place in the diamond.

In the experiment in question one of the spectrum discharge tubes was sealed off just before the conversion, when the diamond was commencing to blacken on the surface, while the other was sealed off after the diamond had been converted into coke. These two tubes, therefore, respectively contained samples of the residual gas before and after the conversion. Their spectra have been photographed alongside of one another, but though they are not altogether the same, the differences do not appear sufficiently marked to determine with exactitude any variation in the nature of the gases present.

The experiments were arranged and carried out by Mr. Swinton at his laboratory in London.

George Westinghouse.

"Equal even to the achievement of saving the big banks from panic," says the *Wall Street Journal*, "will be the achievement of saving George Westinghouse from insolvency.

"Mr. Westinghouse is an inventive genius whose contributions to his country entitle him to the regard and support of all. His financial troubles are the result of the very largeness of his plans and not of any defect in the plans themselves. If his business foresight did not equal his scientific insight, so that he was caught in a panic which other men far less gifted than he foresaw and prepared for—well, no man can be all things at all times, in all emergencies.

"The future of the Westinghouse Electric and Manufacturing Company depends upon the success of the merchandise creditors' reorganization plan. If the plan goes through, the Westinghouse company will be amply supplied with working capital, and for the first time in several years will be given an opportunity to demonstrate what it is capable of doing from the standpoint of earnings when free and unincumbered by debt.

"The receivership of the Westinghouse company was due more to an overabundance of prosperity than anything else. In order to keep pace with the growth of the country and the extraordinary demand for its products, it was forced to burden itself with debts running into the millions. Comparing the financial statements of the Westinghouse company over the last several years it will be found that earnings were increasing and that operating costs were being gradually reduced. The financial panic came at a time when the Westinghouse company was at the height of its prosperity. The banks and other creditors demanded a settlement which the Westinghouse company could not meet, and a receivership could not be avoided.

"From present indications the plan of reorganization will be a success. The larger creditors have given it their approval, and it has also received the endorsement of the prominent stockholders. Creditors and stockholders are working in harmony with Mr. Westinghouse in an effort to free the company from receivership and thereby place it on its feet once more. The receivership of the Westinghouse company does not mean that the corporation is not making a good showing in the matter of earnings. Its earnings for years past have been in excess of dividend requirements. While the company is suffering as a result of the current depression, the prospects are that with ample working capital it will be able to make some new high records from the standpoint of income when business conditions become normal, and that stockholders will not have to wait a great while for a restoration of dividends. The successful conclusion of the present reorganization plan will unquestionably result in a material enhancement in the value of the company's securities.

"Few companies have contributed more toward the development of the country than the Westinghouse Electric and Manufacturing Company, and it is because of this that business men hold that a continual receivership and the sale of the property at a sacrifice could be regarded in the light of a national, perhaps international, business calamity."

United States Civil Service Examination for Electrician.

An examination will be held on May 13 to secure eligibles from which to make certification to fill a vacancy in the position of electrician, $1,000 per annum, Quartermaster's Department at Large, Columbus Barracks, Ohio; and vacancies requiring similar qualifications as they may occur in any branch of the service. The duties of the specific position to be filled require thorough knowledge of and experience in wiring, installation of electric lighting fixtures and construction of pole lines, ability to read and test wattmeters, and to care for and make slight repairs to transformers and arc lamps. The age limit is twenty years or over on the date of examination, and the examination is open to all citizens of the United States. Applicants should apply at once to the United States Civil Service Commission, Washington, D. C., for application form No. 1,052.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

American Industrial Conditions from a Workman's Viewpoint.

The author of this communication, who is a New England machinist, here gives his views of the present conditions of his trade in this country. During his youth the owners of shops and foundries showed much interest in the welfare of their workers and were satisfied to get a fair profit from their work. It was to their interest to train the apprentices thoroughly so as to make good workmen out of them. Nowadays the pay for apprentices is so small that it does not attract the best men, who can get much better wages for other kinds of work, and when they are employed they are maintained in one department and not shifted from point to point so as to teach them the whole trade. The workman to-day has some ideas regarding just profits; he knows something about watering stock. He believes that he is the real taxpayer, and he sees the load on his back growing larger each year, with no relief in sight. The manufacturers to-day all belong to one or more associations of mutual interest; they employ the best local talent and advice, while the workman has no one to look after his interests. The author has brought up three sons, whom he prepared for the machinist's trade, but all three refused to learn it, one taking up drafting, the second becoming a locomotive engineer, and the third studying dentistry. The latter was receiving $6.50 while learning dentistry after three months' work, while as an apprentice he could obtain only from sixty-five to eighty-five cents a day. Manual training and three summers spent studying drafting seemed to the shop foremen of no value, as he was offered no more than an untrained youth could obtain.—*Abstracted from the Engineering Magazine (New York), April.*

Recent Developments in the Gas Turbine.

The death of M. R. Armengaud last summer left his work on the gas turbine far from completion. This was later taken up by Alfred Berbezat, who here tells what progress was made during the past year. The early experiments were made with a small turbine of the De Laval type developing about thirty horse-power, the performance of which, when driven by compressed air, was studied. The results being encouraging, a larger machine was built, the general principle of which involved delivery of air under pressure into a pear-shaped chamber lined with refractory material and provided with an expanding nozzle through which a uniform flow of gases can be delivered upon the blades of the wheel. In the centre of the air nozzle is arranged an axial tube with a pulverizer in the end, through which the fuel in the form of gasolene or similar liquid hydrocarbon is forced into the chamber. An electric sparking device enables the fuel to be ignited on starting, after which the high tension of the chamber maintains the combustion indefinitely. The high temperature produced by the combustion greatly increases the volume of the air, and this, together with the gaseous products of the combustion of the fuel, flows at a high velocity through the expanding nozzle upon the blades of the wheel. In dealing with such high temperatures, which are about 1,800 degrees centigrade, the best refractory lining for the combustion chamber has been found to be carborundum, a product of a much higher temperature than is attained in the combustion chamber. This lining has an elastic backing of asbestos to provide for expansion, and the nozzle through which the gases are discharged upon the wheel is also made of carborundum. It has also been found necessary to surround the combustion chamber with a water jacket. The water thus heated is delivered through small holes into the gases just before they enter the nozzle and is there converted into steam, acting both to lower the temperature of the issuing gases and being itself discharged against the wheel. To secure the full advantage of the gas turbine, no reciprocating mechanism should be employed. This calls for a highly efficient rotary compressor. The type of pump finally adopted for this work was a multiple turbine compressor designed by Rateau, which gives a pressure of from ninety to 100 pounds per square inch, with an efficiency ranging from sixty to seventy per cent. With this arrangement the compressor absorbs about one-half of the total power developed by the turbine when running at about 4,000 revolutions a minute and developing about 300 horse-power over and above the work required to drive the compressor. At the present time experiments are being made upon the thermal efficiency of this turbine, which is as yet not as high as that of the reciprocating gas engine. An interesting application of this type of turbine has been made recently for driving submarine torpedoes. The turbines for this purpose developed 120 horse-power at 1,000 revolutions, the turbine alone weighing about 160 pounds—about 1.3 pounds per horse-power. The gas turbine is still in the experimental stage, but seems to have made considerable progress during the past year.—*Abstracted from Cassier's Magazine (New York), April.*

Transformers and Metallic Filaments.

The suggestion that small transformers be employed to enable the low-voltage metallic-filament incandescent lamps to be operated from the usual lighting circuits is here criticized. It is the object of these transformers to reduce the potential to twenty-five or thirty volts, and since they would be of small output, they might be attached to the lamp fixture or to the distributing panel. The objection to this is that it presumes finality in lamp making and makes no allowance for further development. It says in effect that the 200-volt lamp of the metallic-filament type can never be produced in small units, and it presupposes that the lamp at present made for voltages in the neighborhood of 100 will be too fragile for ordinary use; that the eight and five-candle-power lamps can not be made, and that the lamps will never be suitable for burning in any position. This idea is not in accord with the history of incandescent lamp-making, as, relatively speaking, the newer forms of lamp have only just been introduced. The transformers would then be merely a makeshift of temporary value, since it seems certain that the lower-candle-power, high-voltage lamps will, before very long, be produced in commercial form. The tantalum lamp has already been made for 100-volt circuits in twenty-five-candle-power units, and in sixteen-candle-power units for 130-volt circuits,

and is now used for alternating currents. The various forms of tungsten lamp are now struggling toward higher voltages, and some units have already been brought out for 200 and 250-volt circuits. Judging from what has already been done, it will be but a short time before metallic-filament lamps are available for any ordinary voltage, in any ordinary candle-power, for use in any ordinary position. When this has been done the transformer will, of course, be discarded, but in the meantime it will have given to the general consumer the idea that electric lighting systems are exceedingly complicated.—*Abstracted from Electrical Times (London), April 2.*

The Nature of Gamma and X-Rays.

The experiments which led Professor Bragg to conclude that gamma rays are not ether pulses, but rays consisting of neutral pairs, are here discussed by C. D. Cooksey, who has conducted some work along the same general lines, using, however, X-rays, and obtained similar results, but who does not draw from them the same conclusions. Bragg showed that the secondary cathode rays coming from the side of a substance upon which they fall differ in the amount of ionization which they produce from those coming from the side from which the gamma rays emerge. He also showed that the emergence cathode rays from a substance of low atomic weight are greater than those from a substance of higher atomic weight, while with the incidence cathode rays, the substance of high atomic weight gives off more than the substance of lower. The author has followed Bragg's method, employing pairs of metals consisting of lead and aluminum, copper and aluminum, and copper and lead, and found in every case the ionization due to the emergence secondary cathode rays was greater than that due to the incidence rays. The incidence secondary rays were, in different experiments, from fifty to ninety per cent of the emergence. It was found that the thickness of the layer of copper from which the secondary rays can emerge is not great enough to absorb the primary rays to an extent sufficient to account for the marked difference between the emergence and incidence rays. On the other hand, both the emergence and incidence secondary radiation produced greater ionization when coming from a metal of high atomic weight than from one of lower weight. This difference was very marked with the above pairs and also with lead and carbon. This is directly opposite to the effect observed by Professor Bragg for gamma rays. These experiments, as well as those of Professor Bragg, show that for both X-rays and gamma rays the secondary cathode rays are not produced equally in all directions, but the author does not agree with Professor Bragg that the evidence is conclusive that X-rays and gamma rays must consist of some type of radiation other than electromagnetic pulses. He gives as a reason for this lack of symmetry in the secondary radiation that these secondary rays may be the negative parts of the primary pairs which constitute the primary rays, and that these pairs naturally possess momentum in the direction of propagation. The author points out, however, that an electromagnetic pulse possesses momentum also in the direction of propagation. Though little is known of the mechanism of the production of secondary cathode rays by ether pulses, it is not unreasonable to suppose that an ether pulse could contribute some of this momentum to the secondary cathode particles, causing them to go more in the direction of propagation of the primary than in any other. Since it is known that X-rays come from a region where electrons are being violently accelerated, and must, therefore, consist in part at least of ether pulses, and since all previous experimental evidence has been favorable to this pulse theory, it seems more reasonable to look to this theory than to propose a new theory of neutral pairs. On the other hand, it must not be overlooked that this lack of symmetry in the secondary cathode rays is a difficulty in the way of the ether-pulse theory.—*Abstracted from Nature (London), April 2.*

The Globe Photometer in Practical Photometry.

The use of the Ulbricht globe photometer for determining mean spherical and mean hemispherical candle-power by a single observation is discussed here by Dr. L. Bloch. This is the simplest of all instruments which give these values in a single measurement. Moreover, it is easier to use and does not require the same expert manipulation on the part of the user as the other types. The globe photometer consists of a hollow globe from one to two metres in diameter, coated on the inside with some diffusing paint, and with openings for inserting the source of light, a screen for cutting off the direct rays of this light and for the optical instrument. With this photometer it is immaterial where the source of light be placed, provided, of course, it is within the globe. The theory of the photometer shows that under this condition light diffused from the surface of the sphere will be uniformly distributed, and hence any photometric screen placed at the surface of the sphere, when shielded from the direct rays of the source of light, will be illuminated to an intensity directly proportional to the average amount of light thrown off by the source into the globe. Hence, if the light be entirely within the globe, this will be proportional to the mean spherical candle-power; while if the lamp be placed so that only the light thrown in the lower hemisphere falls within the globe, the figure will be proportional to the mean hemispherical candle-power. It is thus necessary merely to calibrate the instrument once for all and then place the lamps to be measured in the most convenient position. Arc and incandescent lamps may be inserted through an opening in the top, flame lamps through an opening in the bottom, while the opening for the photometric instruments is most convenient in the side. The instrument is most conveniently calibrated by measuring the intensity of illumination given by an incandescent lamp whose mean spherical candle-power is accurately known. This constant, once determined, is applicable to measurements of all sources of light. The most convenient size for these globe photometers is from twenty-four inches to six feet. The smaller sizes are more convenient for incandescent lamps, the larger sizes for arc lamps with large diffusing globes. Photometers as large as ten feet in diameter have been constructed for special purposes, but are not suitable for use with small lamps, as the illumination is then too low. The smaller globes are made of spun metal such as zinc or iron, while the larger ones are easily built up of segments. The interior should be coated with a white diffusing paint with a matte surface. Barium sulphate or zinc white may be used. The latter is the better, as it does not darken. It is important that this coating should not be at all shiny. The same photometer may be used for both mean spherical and mean hemispherical candle-power by merely raising the lamp out of the globe until the centre of radiation is at the surface of the sphere. This adjustment is rather delicate, so that it is most convenient to determine once for all the ratio between the mean spherical and the mean hemispherical intensity for each type of lamp and then to measure the mean spherical, from which the mean hemispherical may be deduced. A similar process is suitable for determining the mean horizontal candle-power.—*Abstracted from the Illuminating Engineer (London), April.*

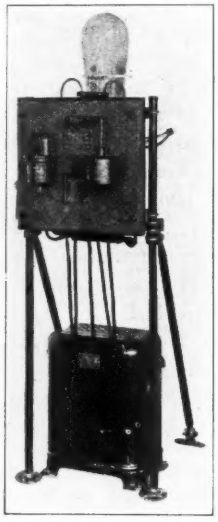
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Mercury-Arc Rectifier in Moving-Picture Shows.

One of the most recent applications for which mercury-arc rectifiers have proved very successful is in the operation of arc lamps for moving-picture shows.

The arc lamps which are used as the light source for moving pictures are usually operated from thirty-five to sixty amperes on alternating current and at about twenty-five to thirty amperes on direct current. Up to a few years ago they were operated in series with resistances on 115 or 220 volts to bring the lamps to the proper arc voltages. This



FRONT VIEW, GENERAL ELECTRIC RECTIFIER FOR MOVING-PICTURE ARCS.

makes a wasteful consumption of energy, which is considerably more for the alternating-current lamps on account of the higher amperage necessary for producing a light of sufficient intensity. The problem to overcome this waste of energy has in the last few years been given considerable attention by some of the industries active in this business. The current bills of the enterprises form a large part of their fixed expenses, averaging from about $40 per month for the smaller exhibitions, which operate only three or four times in one evening, to bills of several hundred dollars per month for the large city establishments which give performances during the greater part of the day and night.

Apparatus for efficiently cutting down the voltage on the direct-current lamps must of necessity be of a much more expensive and elaborate outfit than a device designed for a similar purpose for alternating current. The initial cost of the former has prevented its general adoption except for locations where only 500-volt direct current is available, as in summer resorts operated by street-railway interests. On the other hand, the problem for overcoming the waste of energy in rheostats on alternating-current lamps has been at least superficially overcome by the use of compensators, choke-coils and similar devices which have been widely advertised and aggressively exploited by many moving-picture trade interests.

It is, of course, patent that most of these alternating-current devices, although in certain respects less wasteful than rheostats, possess a low power-factor, which makes them inefficient from a central-station standpoint.

The direct-current arc lamp is a better source of light for moving pictures than the alternating-current arc, principally on account of the greater steadiness of its arc, and the lower watt consumption necessary to produce a sufficiently brilliant light.

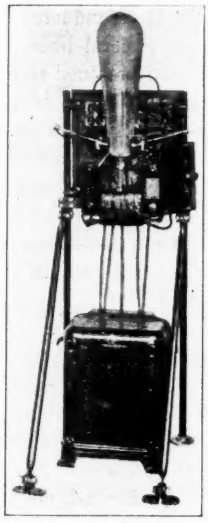
The question, therefore, arises, "What is the best way to obtain direct-current from alternating for this class of service?"

The General Electric Company has recently designed and sold a number of rectifiers adapted especially for use in supplying direct current to moving-picture arcs, where only alternating current is available. The back and front views of one of these rectifier sets are shown herewith.

This rectifier set is designed for operation on a 220-volt, alternating-current circuit, and has a continuous capacity of thirty amperes direct current and a capacity of forty amperes, or slightly more, during the starting of the arc. The rectifier is designed to deliver a direct-current voltage equal to that required across the arc, or from forty-five to fifty volts. A reactance in series with the alternating-current supply serves to steady and regulate the current taken by the arc lamp. This eliminates the necessity of having a wasteful resistance in the arc circuit.

The rectifier set is similar in some particulars to the battery-charging rectifier now in common use. The regulating features and other parts necessary for battery charging, but not required for this service, are omitted, and the rectifier equipment reduced to its simplest form. The rectifier may be installed at a distance from the picture-machine operator, for instance in the basement. The rectifier may be started by the operator without leaving his booth.

The only operation necessary to start the rectifier, after the supply switch is closed, is to touch the two carbons of the



REAR VIEW, GENERAL ELECTRIC RECTIFIER FOR MOVING-PICTURE ARCS.

arc lamp together, hold them so for a second or two, and on separating the carbons a direct-current arc will be drawn. The closing of the carbons simply allows the current to flow through the shaking-coil on the panel, which tilts the tube once or twice and causes it to start. There is no doubt that the simplicity of the arrangement of this rectifier equipment will appeal to many owners and managers of moving-picture theatres. These rectifiers already installed in moving-picture shows have received unstinted approval and praise from the owners.

The rectifier not only furnishes direct current for the arc lamp so that better light can be obtained from an alternating-current circuit, but the cost of the operation is said to be very much less than with either alternating current or direct current, with a resistance in series with the arc.

The Apple Portable Storage Battery.

The Apple Electric Company, Dayton, Ohio, has placed on the market its improved storage battery for automobile, motor-boat and stationary gas-engine electric ignition and lighting, or for any purpose requiring low-voltage constant current. This battery has been developed to withstand the rough usage which is inseparable from this class of service. The plates used are spaced by substantial and specially treated separators, and the grid is made of an alloy of lead and antimony. The plates, together with the complete elements, are joined by hard-lead straps, which are burned together. The unit system of heavy rubber jars is used, making it possible, if necessary, to replace any one of them separately. The jars are firmly sealed by a special sealing com-

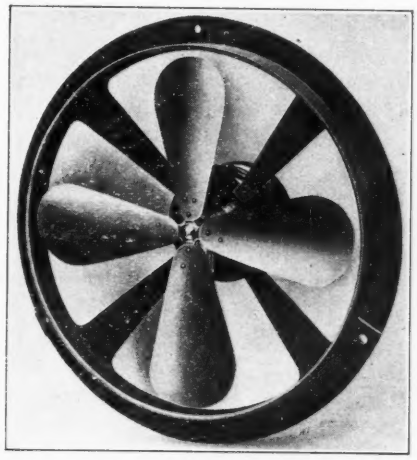
Apple Portable Storage Battery.

pound into a finely finished oak case, which is so constructed as to do away with all screws and nails. The corners are all rounded, together with the inside edges at the top. This rounding of the inside edge, in connection with the sealing compound, forms a recess to hold any acid solution that may be spilled in falling, preventing any overrunning on the sides of the case. The case has no flanges, so that it will fit well in battery boxes. The connections have been reduced to the two necessary binding posts for the line wires. These are one-half-inch hard-lead threaded stems, which are burned to the elements. Two hard-rubber knurled caps are used to bind the line wires to the lead stems.

The Apple Electric Company has been formed by V. G. Apple, H. F. Apple and O. D. Apple, who have withdrawn from the Dayton Electrical Manufacturing Company.

The Westinghouse Ventilating Fan.

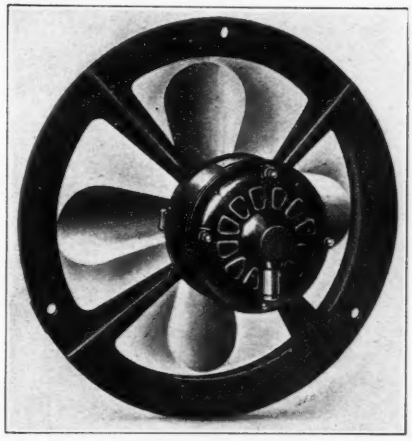
The ventilating fan illustrated herewith is an important addition to the line of Westinghouse fans offered for 1908. Both electrically and mechanically it possesses all the good features of the standard Westinghouse fan motors and it differs from



Front View, Westinghouse Ventilating Fan.

them chiefly in the action of the blades and in the method of mounting. It consists of a propeller fan carried on the motor shaft and secured within a circular supporting frame for mounting in any convenient opening.

It is designed to act as an exhaust fan for the ventilation of rooms and for draw-



Rear View, Westinghouse Ventilating Fan.

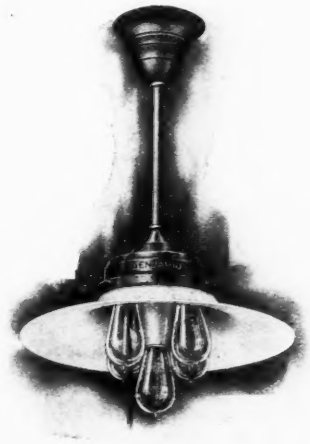
ing off the odors and fumes incident to cooking and similar operations. It exhausts the vitiated air, which is replaced by pure outside air in a natural way without creating any noticeable drafts, and thus affords a most effectual and satisfactory method of ventilation.

This fan is made for both alternating and direct-current circuits, and with twelve and sixteen-inch blades. The current consumption is practically the same as that of the Westinghouse desk and bracket fans of the same dimensions.

By exhausting the dead air and drawing in a supply of fresh air to replace it, and thus insuring a continuous gentle current, this fan recommends itself as a substitute for the blowing fan wherever the more vigorous action of the latter is undesirable, as, for instance, in the sick chamber and in sleeping apartments both summer and winter. Wherever another opening is not available, the fan can be readily mounted upon a wooden frame to fit into a corner of the window.

The Benjamin Tungsten Arc.

One of the most interesting lighting specialties which have been placed upon the market is the Benjamin tungsten arc, designed and manufactured by the Benjamin Electric Manufacturing Company,



The Benjamin Tungsten Arc.

Chicago, Ill. The accompanying illustration shows this fixture as adapted for indoor work. The fixture measures twenty-five inches over all, and consists of a stem of three-eighths-inch pipe, a three-quarter-inch casing, crow-foot, wires, deep canopy, cluster body and eighteen-inch opal reflector. The brass base is provided with a conical-shaped frosted aluminum reflector, which materially increases the reflecting surface of the device. It is furnished in four to six lights, either with or without a centre lamp opening, and with or without a pendant switch. It is symmetrical in outline, pleasing in appearance, and offers an effective and economical fixture for public lighting purposes.

The G & W Ground Pipe Cap.

The accompanying illustrations show the new device which has been placed on the market by the G & W Electric Specialty Company, 128 West Jackson Boulevard, Chicago, Ill.

The method of making ground connections on alternating-current circuits, lightning arresters, etc., has in recent years become generally standard. This standard method consists of driving a five-eighths-inch galvanized wrought-iron pipe into the ground at the unexposed side of the pole to the necessary depth to reach permanently moist soil. The ground wire is then joined to the top of the pipe. It is sometimes the custom to make this joint about seven feet above the ground, and cover the ground pipe and wire with a wooden molding. Where the pipe is covered it requires rather a large molding, and the soldering of the wire into the pipe at the top of the ground is objectionable, because of the possibility of the solder acid starting corrosion at that point, and because of the time required to do the soldering effectively.

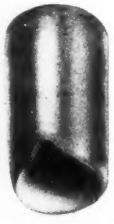


FIG. 1.—GROUND CAP BEFORE DRIVING.

FIG. 2.—GROUND CAP WITH WIRE INSERTED, ON PIPE, READY FOR DRIVING.

The G & W pipe cap has been developed to save the cost of the portion of the pipe above the ground and its molding, to give a good driving head for the pipe, and to make a good joint between the pipe and the wire at the top of the ground. The cap is shown in Fig. 1. It consists of a hollow galvanized malleable casting, internally grooved along one side, and so shaped at the mouth that the end of the ground wire can be introduced into the casting along the groove. The cap, with the wire in place, is placed upon the top of the pipe and the pipe driven. In driving the pipe the cap is driven on and the copper wire wedged in securely between the inside wall of the cap and the outside of the pipe. Fig. 2 shows the pipe cap properly fastened. The cap protects the top of the pipe from being battered out of shape and saves the time required to cut off the battered end, as is sometimes necessary in driving pipe in hard soils. The cap also serves to make a joint of good conductivity between the ground wire and the pipe.

The Federal Tungsten Cluster.

The accompanying illustrations show a very effective lighting device which has been placed upon the market by the Federal Electric Company, Lake and Desplaines streets, Chicago, Ill. Fig. 1 shows the Federal indoor cluster for use with tungsten lamps. This is a simple, effective and inexpensive cluster for store lighting, designed with a view to making expensive glassware unnecessary. It is made with a twenty-inch glass shade and an eighteen-inch stem, having a one-inch casing and a seven-inch canopy. The centre disc, in which the sockets are placed, is made of porcelain-enameled steel.

Fig. 2 shows the Federal outdoor arc for tungsten lamps. This is an exceedingly substantial fixture for the purpose. It has a cast-iron enameled upper canopy, a twenty-inch porcelain-enameled steel shade and a porcelain-enameled steel under-body, in which the sockets are set. This gives an excellent reflecting surface. The lamps are protected against theft or breakage by a clear-glass dome, which has a hole in the bottom and is so fastened to the top that there is a good circulation of air. These tungsten clusters are meeting with great success in competition with gas arcs.

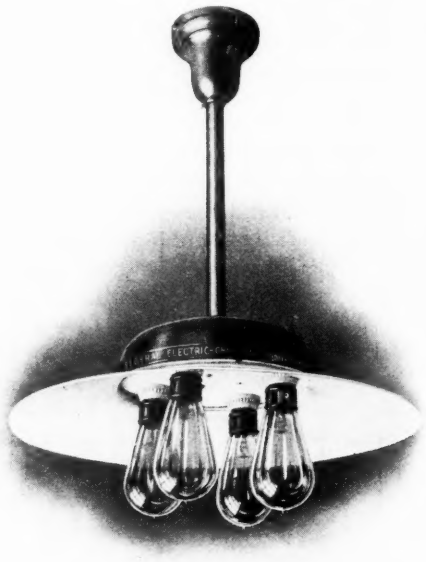


FIG. 1.—FEDERAL TUNGSTEN CLUSTER FOR INDOOR SERVICE.

A four-light cluster equipped with three sixty-watt tungstens and one 100-watt tungsten costs about two and one-half cents to two and three-quarter cents per hour at a rate of ten cents per kilowatt-hour. The experiments of the Economy Light and Power Company, of Joliet, Ill., have brought such results as to make the company offer the following proposition covering renewals: "Lamps renewed for twenty-five cents per four-light fixture per month." Actual tests have indicated that

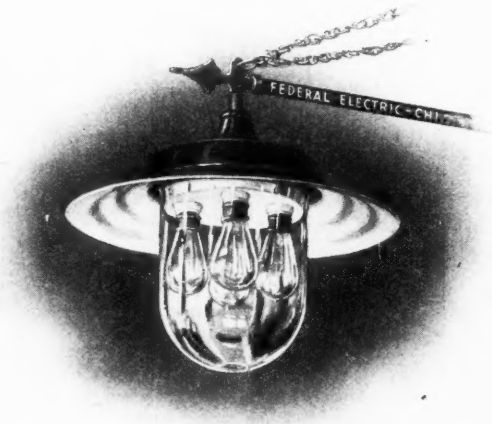


FIG. 2.—FEDERAL TUNGSTEN CLUSTER FOR OUTDOOR SERVICE.

a Humphrey gas arc costs about two and one-third cents per hour to operate with a gas rate of $1 per 1,000 cubic feet.

In addition to the satisfactory illumination, the electric light is cleaner, gives a better color value and eliminates a great deal of cleaning and other troubles. These tungsten arcs should be of great advantage to the central station in competing with other forms of illumination for either indoor or outdoor service.

How Electric-Motor Equipment is Regarded by Machinery Manufacturers.

The attitude which is being assumed by leading manufacturers of machinery of various types in regard to electric-motor drive shows that this form of drive is rapidly gaining ground and that the standard machine of the near future will be a unit including the motor. Many manufacturers who formerly stated in their catalogues that motor drive would be furnished if desired, or that their machines would be equipped for it upon order, are now illustrating their latest types of machines with motors already attached, while the older forms of drive are relegated to the background.

There are two reasons for this: the demand upon the part of the user for motor drive and a realization upon the part of the manufacturer that the motor affords an important contribution to the efficiency, economy and convenience of the machine.

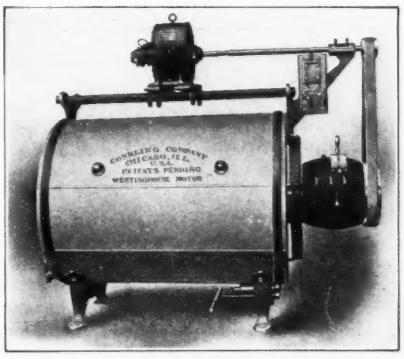


FIG. 1.—BELT-DRIVEN WASHING MACHINE.

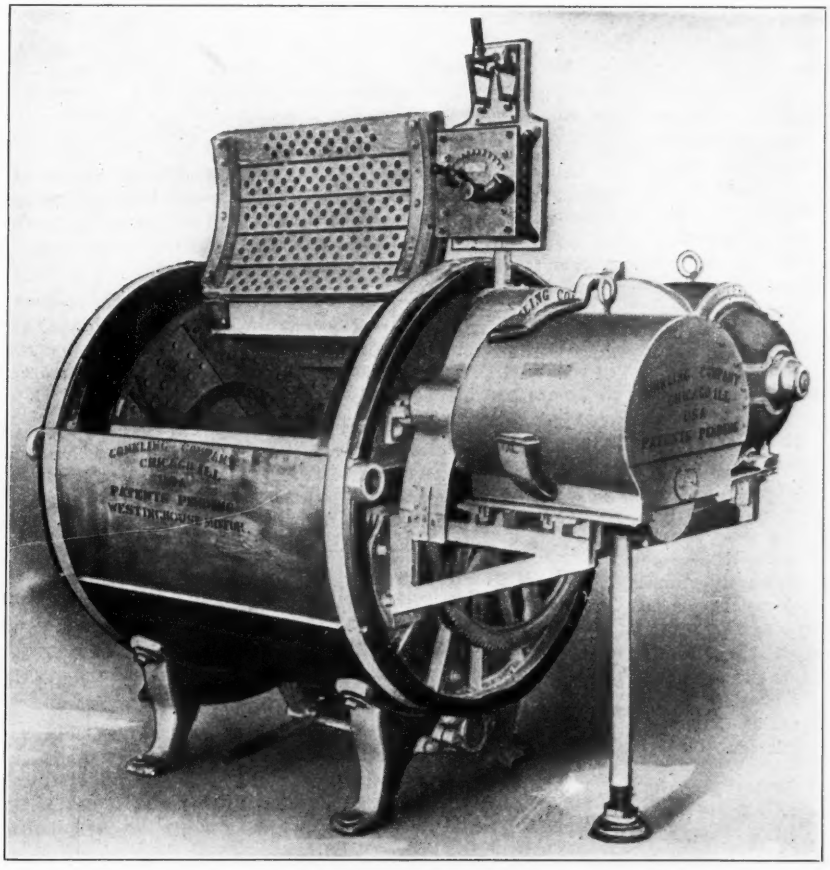


FIG 2.—WASHING MACHINE DRIVEN BY BACK-GEARED MOTOR.

Many manufacturers have anticipated the situation by devoting their attention to improved methods of attaching the motor, with highly gratifying results. The case of the Conkling laundry washer may be taken as an example. The principal feature of this machine is the automatic reversing mechanism, so arranged that the inside cylinder makes equal revolutions each way. This mechanism did away with the double-belt arrangement otherwise required for reversing, and required but one belt from the shafting. When it came to attaching an electric motor, the original arrangement consisted of a frame extending across the top of the machine. The motor was secured to the middle of this frame and provided with a long shaft, driving a pulley in line with the pulley on the reversing mechanism and connected by a belt, as shown in Fig. 1. As the demand for motor-driven machines increased, a more compact and satisfactory arrangement was sought. The result of the efforts of the Conkling company's engineers is shown in Fig. 2, where the motor rests in a position directly behind the reversing mechanism and is geared directly to it. Westinghouse motors were selected for both methods.

The improved arrangement has many advantages over the old, and makes the unit one of the most satisfactory machines in the equipment of the modern laundry. By doing away with the belts and gearing the motor directly to the reversing mechanism, a more compact and substantial outfit is provided. The use of belts about laundries is always attendant with more or less dirt and oil, which compels some rewashing. By using gears which are entirely enclosed there is no possibility of the clothes becoming soiled from the machine.

Interborough Wins Decision Concerning Its Surplus Power.

The Interborough Rapid Transit Company, New York city, has a right to sell its surplus electric power, even though the power is carried through ducts owned by the city. This is the essential feature of the decision of the Appellate Division of the Supreme Court of New York city. A short time ago the Public Service Commission obtained an injunction restraining the company from selling the surplus current generated in its power-houses and carried through the subway ducts. The purchaser in this case was the New York City Railway Company. The injunction was set aside in an opinion written by Justice McLaughlin, who says that it is a question of the terms of the subway lease, and the court holds that since the selling of surplus current does not interfere with transportation, the sale is legal under the contract.

Current Electrical News

DOMESTIC AND EXPORT.

INTERURBAN ROAD AUTHORIZED TO MAKE LARGE BOND ISSUE—Permission to the promoters of the Atlanta & Carolina Railway Company to issue $6,000,000 bonds has been granted by the Georgia railroad commission. This is the proposed electric line running from Augusta through Atlanta to West Point, which will make it one of the longest and most important interurban lines in the state of Georgia. Captain James W. English, of Atlanta, is president of the company.

GREAT WESTERN POWER COMPANY INCORPORATED—Articles of incorporation of the Great Western Power Company have been filed for record with the Sutter County clerk in Yuba City, Cal. The articles show that the power company, whose lines will traverse Sutter County, is incorporated with a capital of $25,000,000, divided into 250,000 shares of par value of $100 each. The object of the company is given as a general electrical power business and the directors are as follows: Guy C. Earl, Oakland; W. H. Spaulding, Oakland; H. C. Young, Richmond; E. A. Cowe, Richmond; W. Stairley, Richmond; B. C. Carroll, Oakland; F. D. Madison, San Rafael; W. S. Rheem, Richmond; L. D. Dim, Richmond.

STANDARD OIL COMPANY OBTAINS CONTROL OF GAS, LIGHT AND POWER COMPANIES IN CALIFORNIA—A financial deal which will practically place all the gas, electric light and power companies of central and northern California under the control of the Standard Oil interests has been made. The deal involves $45,000,000. The initial step in the deal was the making of a mortgage and deed of trust for $45,000,000 from the California Gas and Electric Company to the Union Trust Company, of San Francisco, in January last. This deed gives one corporation control of the gas and electric plants of twenty-five counties of the state. As part of the scheme, a bond issue of $45,000,000 at five per cent has been arranged. This issue will retire all loans of all companies and provide an additional $6,000,000 of working capital.

NORTHERN COLORADO POWER COMPANY—A $3,000,000 bond issue was authorized at the annual meeting of the Northern Colorado Power Company on April 4. The proceeds from the sale of the bonds is to be used in extending the work of the company in northern Colorado. The plans include the stretching of power lines to practically every town north of Denver. The company has a plant now in operation at Lafayette with sufficient capacity for all needs and the work to be done is to lay transmission lines to carry the power to the towns which are to be supplied. This will begin as soon as the bonds are sold. The following were elected officers for the ensuing year: William J. Baker, president; George C. Smith, of New York, vice-president; George Best, secretary, and Thomas Keely, treasurer. N. A. Carle tendered his resignation as vice-president and general manager and will return to New York, where he will be associated with Westinghouse, Church, Kerr & Company. George C. Smith, the new vice-president, is vice-president of the Electric Properties Company, of New York, a subsidiary corporation of the Westinghouse Electric and Manufacturing Company. He represents the Westinghouse company in the Colorado corporation, in which it holds the controlling interest.

NEW MANUFACTURING COMPANY.

BIRMINGHAM, ALA.—The American Automatic Railway Switch Company, capitalized at half a million dollars, has filed papers of incorporation. It is proposed to begin business with $350,000, and the objects of the company are to manufacture, buy, sell and deal in street and other railway switches, frogs and other railroad devices. The location of the principal offices will be in Birmingham. The officers are: Harold Shernwell, president; J. R. Vail, vice-president; Ben F. Barbour, secretary, and J. B. Dryer, treasurer.

ELECTRIC RAILWAYS.

NASHVILLE, TENN.—The Nashville Railway and Light Company will extend its St. Cecelia line to a point near White City Amusement Park, work to begin immediately.

MERIDIAN, IDA.—At an adjourned meeting of the town council an ordinance was passed granting the Boisé Valley Railway Company a fifty-year franchise through the town of Meridian.

VANCOUVER, WASH.—The franchise of the Washington Light and Power Company, which proposed to build a car line in Vancouver, has been declared forfeited by the city council.

GOLDSBORO, N. C.—At a meeting of the board of aldermen an ordinance was passed granting a franchise to E. T. Oliver and his associates for the construction and operation of a street railway system in Goldsboro.

ALBANY, ORE.—Active construction work on the Oregon Electric Railway Company from Salem to this city has been begun. W. S. Barstow & Company will construct the extension to Albany, which will be twenty-seven miles long.

INDIANAPOLIS, IND.—It is officially announced that the Vincennes, West Baden & Louisville electric line will begin the construction of its line, forty-two and one-half miles in length, to connect Vincennes and Monroe City with West Baden.

PORTLAND, ORE.—The Oregon Electric Railway is preparing to begin work on its proposed Hillsboro extension, and hopes to have the line in operation next fall. The company will then take up the work of building south to Albany, from Salem, and later to Eugene.

PORTLAND, ME.—Orville J. Gonya, one of the promoters of the proposed electric road between Ridlonville and Bethel, is authority for the statement that work will be started in June. The road will be about thirty miles long, and will handle both passenger and freight traffic.

MATTOON, ILL.—The Mattoon city council has passed an ordinance granting a franchise to the Mattoon, Shelbyville, Pana & Hillsboro Traction Company to operate its system in the streets of that city. This is the last link in the interurban system between Hillsboro and Mattoon.

CHICAGO, ILL.—The members of the Chicago Railways Company reorganized directorate are as follows: H. A. Blair, chairman; J. M. Roach, F. H. Rawson, W. M. Eisendrath, H. Washburne, A. B. Jones, J. W. Gary and W. Heckman, all of Chicago. The finance committee consists of H. A. Blair, Chauncey Keep and B. A. Eckhart.

OIL CITY, PA.—Oil City, Titusville and Pleasantville capitalists have organized the Pleasantville Traction Company to build a trolley road between this city and Titusville. The line will be twelve miles long. It will connect with the Citizens' Traction Company here, making a trolley connection along Oil Creek from Franklin to Hydetown.

BELLEVILLE, ILL.—The Southern Traction Company, of Illinois, which has a franchise to construct a trolley line between this city and East St. Louis, has awarded a contract to Hoeffken Brothers for grading its roadbed within the city limits of Belleville. Contracts have also been let for grading the proposed route between Belleville and East St. Louis.

MARQUETTE, MICH.—The promised interurban line connecting Marquette with Negaunee and Ishpeming practically is said to be assured. The Farwell interests, of Chicago, have taken up the project, and announcement is made that, the report of the engineers having been favorable, the road will be constructed this year. The capitalists concerned already control the Marquette County Gas and Electric Company, which is operating a three-mile trolley road

connecting Ishpeming and Negaunee. It is proposed to extend this line to Marquette, a distance of twelve miles.

RENO, NEV.—George S. Phenix, president of the company building an electric railroad from this city to Steamboat Springs, about fourteen miles south, states that he expects to have cars running between Reno and Steamboat in six months and that the line will be extended into the Jumbo mining district, which is now being rapidly developed.

WALLA WALLA, WASH.—The county commissioners have granted a franchise for an electric railway along the east side of the city to the Washington cemetery to the Oregon Traction Company. This is taken to mean an extension of the present interurban system south of the city, thence westerly near the Oregon line to the Hudson Bay section, which is rich in alfalfa lands.

CARMI, ILL.—Officials of the Toledo, St. Louis & New Orleans Railroad Company have elected Nathaniel M. Burns, of St. Louis, president; Dent Reid, of Marion, vice-president; Henry Semple Ames, of St. Louis, treasurer, and Thomas W. Hall, of Carmi, secretary. The company will build a line from Effingham to Brookport, tapping fluorspar deposits in the southern part of the state.

RICHMOND, VA.—Receivers for the Virginia Passenger and Power Company, under authorization of the United States courts, Judge Waddill presiding, have completed expenditures for improvements on the properties amounting to $435,000 and have under way plans for expending about $70,000 more, which will make a total of $505,000. The latest expenditure is to be for a substation in Church Hill.

GETTYSBURG, PA.—C. Taylor Leland, of Philadelphia, has been appointed receiver for the Gettysburg Transit Company, which controls the trolley lines over the Gettysburg battlefield. The company is said to have liabilities amounting to about $10,000, while its only resources are the rolling stock and the line. Mr. Leland says that as soon as possible the affairs of the old company will be settled and a new organization formed.

TITUSVILLE, PA.—The promoters of the proposed trolley line from Titusville to Oil City have applied for a charter under the name of the Pleasantville Electric Company. Subscriptions to the amount of $40,000 have been secured. The new road will connect with the Titusville line at Pleasantville; from there follow the old Pithole through Plumer, and to Rouseville the line will follow the old Culver grade. It will connect with the Oil City line at Rouseville.

CHARLESTON, S. C.—Announcement has been made by the board of directors of the Charleston & Summerville Electric Railway Company that a meeting of the stockholders of that concern will be held on May 29 for the purpose of voting to increase the capital stock of the company by not more than $249,000 additional common stock and $100,000 preferred stock, thus making the capital stock of the company $300,000 common stock and $100,000 preferred stock.

SULPHUR, OKLA.—E. M. Hopkins, president of the Detroit Interurban Railway Company, who, with Scott Jones, of Chickasha, is behind the project to build an interurban line between Sulphur and Chickasha, has informed those interested in the proposition that work will begin on the line within three months. Anadarko is to be eventually the western terminus.

YORK, PA.—Fifty thousand dollars is being raised by financiers and prominent residents in the lower section of this county for the building of a trolley road to connect York and Baltimore, Md. Plans are being perfected. The line from York will extend to Turnpike Station, and the southern line from Cockeysville to Baltimore. The distance between Cockeysville and Turnpike is fourteen miles. There is now a line in use spanning the other distance. At the head of the project are: D. B. Goodling, Logansville; J. H. Keller, Shrewsbury; J. Myers, Glen Rock; J. N. Bailey, Logansville; E. J. Beck, Jacobus; James Blouse, C. J. Smith, W. G. Allen and Benjamin Seitz, Shrewsbury.

BROOKLYN, N. Y.—Application has been made by the Coney Island & Brooklyn Railroad Company to the Public Service Commission for permission to issue new bonds to the amount of $462,000 to carry out improvements, chief among which is the shifting of the tracks in Coney Island avenue from the side to the centre of the street. The Coney Island avenue improvement is estimated to cost $278,000. The new issue of bonds will be secured by a mortgage of $10,000,000 on the Coney Island & Brooklyn properties authorized by the State Railroad Commission in December, 1904. Under that order provision was made for the issue of $5,500,000 bonds, and new application for authority to make subsequent issues to the amount of the remaining $4,500,000. The present issue of $462,000 is a part of the unissued $4,500,000.

GREENVILLE, S. C.—The engineering corps of the Carolina Construction Company, of Asheville, N. C., which is promoting the building of a high-speed interurban trolley line from Asheville to Greenville *via* Greer, Flat Rock and Hendersonville, has begun the location of the line from Greenville to Hendersonville, the other end of the line from Hendersonville to Asheville having been surveyed. J. S. Rowland, of Hendersonville, president of the Construction Company, says the finances of the undertaking have already been arranged and as soon as the engineers complete their work active operations will begin, which will be by the middle of August. The company proposes to do a general freight and passenger business. President Rowland says under favorable circumstances the line should be completed and in operation in less than two years.

CHICAGO, ILL.—The Chicago & Oak Park Elevated Railroad Company has practically completed plans for extending its surface line from Oak Park, which is now the terminus of the railroad, to Elmhurst, five miles west of that point. The arrangement involves the formation of a new company to be incorporated and financed as a separate organization, but it will be owned by the same interests which now control the Chicago & Oak Park line. Bonds will probably be sold to cover the cost of the work of construction, but no further details concerning the financial plan will be made public at this time. It is learned that practically all of the right of way has been acquired for the new line, and franchises have been obtained from all villages through which the road will pass, excepting those of Harlem and River Forest. The latter are now being negotiated and it is said to be only a question of a short time when they will be granted.

WATERLOO, IOWA—Plans are under way for the construction, this summer, of an electric railroad 114 miles in length to extend from Waterloo to Perry, with a stub line from Story City to Ames, where connection with an existing road will be made which will carry traffic direct into the city of Des Moines. The name of the new line is the Iowa Railroad and it is financed by capitalists and railroad builders in Chicago and Eldora. The proposed route is from Waterloo direct west to Cedar Falls and then southwest, touching at Fredsville, Dike, Lincoln, Grundy Center, Eldora, Hubbard, Garden City, Story City, Boone, Moingona and Perry. Hourly service between these points is proposed and the route will permit of several hours' reduction in time over any other of the routes now maintained. The men back of the project are: Henry S. Osborne, president, of Chicago; James F. Hardin, second vice-president and treasurer, president of Citizens' Savings Bank of Eldora; Frederic P. Vose, general counsel, a Chicago lawyer. George W. Scott, of Chicago, is the engineer.

OBITUARY NOTES.

MR. SAMUEL B. RAWSON, president of the Dean Electric Company, Elyria, Ohio, died on Thursday, April 9.

MR. LEW CONWAY CARNES, who was one of the best-known travelers from Coast to Coast as the representative of the Crown Electrical Company, of St. Charles, Ill., died suddenly at his home in Aurora, Ill., on April 1, of pneumonia, at the age of thirty-six. Mr. Carnes was very popular with the trade, and was held in high esteem among his fellow travelers. He was buried at Muncie, Ind. He is survived by a widow, a son and a daughter, and by his mother and two brothers.

MR. CHARLES WILLIAMS, a director of the Western Electric Company, and well known in the electrical field, died at his home in East Somerville, Mass., on April 14. Mr. Williams was born in Claremont, N. H., and for more than sixty years lived in Boston and Somerville. He was associated with Professor Bell in the construction of the first telephone line used in Boston. This line reached from Mr. Williams' office, where the Palace Theatre is now located, to his home in Somerville. He was one of the original stockholders in the Bell Telephone Company. He is survived by a widow and two daughters.

ELECTRIC LIGHTING.

MILWAUKEE, WIS.—The vote on the question of establishing a municipal electric light plant resulted in favor of the proposition.

PEMBROKE, ME.—The power plant of the Pembroke Light Company was damaged by fire to the extent of $10,000 on April 11.

MUNCIE, IND.—The Citizens' Electric Light Company, which was given a franchise by the city council in 1905, has been dissolved.

MANISTEE, MICH.—Work has been started on the Douglas Hydroelectric Power dam, to cost about $350,000. It will be 800 feet long.

SYRACUSE, N. Y.—Niagara power is now being used by the Syracuse Lighting Company, current having been turned on on April 12.

EUFAULA, ALA.—Citizens are discussing the feasibility of erecting an electric light plant in the city to be owned and operated by the business men.

NASHVILLE, TENN.—The board of public works has awarded a contract for excavation and foundation work on the proposed addition to the electric light plant.

MARBLEHEAD, MASS.—The municipal light department is installing at the plant a new 200-kilowatt, three-phase, 2,300-volt dynamo and a seventeen and one-half-kilowatt exciter.

CORRY, PA.—The Corry Electric Light Company has passed into the hands of James E. George, of Cleveland, Ohio. Arrangements have been made for extensive improvements to the plant.

KELSO, WASH.—A deal has been closed whereby thirty citizens take over the Kelso Water and Light Company's property. It is said that water mains will be extended, new ones laid, and electrical machinery added to the lighting plant.

GUYMON, KAN.—At a meeting of the city council it was agreed that a city franchise should be granted to the Guymon Electric Light and Power Company for a term of twenty-five years. The company is backed by J. H. Wright and associates.

WENATCHEE, WASH.—The contract for the excavation work for the Entiat Power Company has been let to C. A. Harris, of Entiat. The power company expects to be able to deliver electricity to the neighboring towns and ranchers in about a year.

MOUNT VERNON, IND.—A ten-year lighting contract has been granted to the Mount Vernon Electric Light and Power Company. The company will begin at once the rebuilding of its plant, installing new machinery and replacing the lamps at present in use.

ALBANY, N. Y.—The proposed Schaghticoke plant of the Schenectady Power Company is to be financed by a first issue of bonds to the amount of $1,750,000, and a mortgage will soon be executed for that amount. Work will not be begun on the plant for several months.

DEFIANCE, OHIO—F. L. Hay, an attorney, has been appointed receiver of the People's Gas and Electric Company, of this city. The appointment of a receiver was asked by the Guardian Savings and Trust Company, of Cleveland; the Anderson Coal Company, and the Lorain Coal and Dock Company.

LINCOLN, R. I.—At a meeting of the council the Valley Falls Company, through its agent, Edward G. Chace, agreed to build a lighting plant in the village of Albion if the town would give a contract for lighting its streets. It is the intention of the company to install electric lights in its mill and tenement houses.

SEATTLE, WASH.—The board of regents of the state university has approved the plans for the new power plant to be erected at the state university. The building of this plant, which is to be made a permanent feature, contemplates the expenditure of from $75,000 to $100,000. The board will advertise for bids for construction within a short time.

LOUISVILLE, KY.—At a meeting of the stockholders of the Louisville Lighting Company Matthew L. Akers and D. X. Murphy were elected directors in place of Udolpho Snead, who has moved to New York, and in place of George Gaulbert, recently deceased. F. M. Sackett was re-elected president; Harry Bishop, vice-president, and T. B. Wilson, secretary and treasurer.

PASADENA, CAL.—The city of Pasadena has issued and sold $50,000 worth of bonds for the extension of the street lighting system. It has a municipal plant, of which C. W. Koiner is manager. Mr. Koiner has recommended to the city council that 400 or 500 tungsten lamps be put in for street lighting, in addition to the present equipment.

ST. JOHN, N. B.—At the approaching session of the legislature the Maine & New Brunswick Electrical Power Company will apply for an amendment to its act of incorporation to increase the capital stock from $200,000 to $400,000, for issuing part of the new stock as preferred and part as common stock, and for determining the rights of the preferred stockholders.

WOODBURY, N. J.—The Glassboro & Pitman Electric Company has made a proposition to light Woodbury for one, three or five years, giving the city the option of purchasing the poles, wires and appurtenances at cost price at the end of the contract period. The Glassboro company now furnishes electricity to Glassboro, Wenonah, Pitman and Richwood.

TAYLOR, TEX.—At a special meeting of the city council of Taylor a franchise was granted to the new electric light and power company over all streets. With the franchise effective September 1 meter rates for lights were fixed at a maximum of twelve and one-half cents per 1,000 watts, a reduction of seven and one-half cents as charged by the former Taylor Electric Company.

YORK, PA.—Chief Engineer Cooper, who is in charge of the work on the McCall's Ferry power plant, is authority for the statement that the dam will be finished and the plant in operation by December 25. It is said that work on the dam and power plant will be resumed at once. About 200 men are now employed and the number will be increased from time to time until a full force will be at work.

LIMA, OHIO—The city of Lima may issue bonds for the erection this summer of a municipal electric lighting plant, following the failure of the Schoepf railway syndicate to reduce its present price of $85 per arc lamp. At a mass meeting of citizens a committee was appointed to investigate and that committee has recommended to council to proceed to pass the legislation necessary. The municipal plant will make a bid for commercial lighting.

CHICO, CAL.—J. W. Roper, of the Midas Gold Mining Company, operating in Shasta County, states that the company will spend between $40,000 and $50,000 in the erection of a power plant on Bee Gum Creek, to generate power for the mine, which will be seven miles distant from the power-house. The company has filed on 5,000 miners' inches of water. About 800 horse-power will be generated at first, but this will in time be increased to 2,000 horse-power.

ORION, ILL.—Orion is raising $5,000 in subscriptions for the rebuilding of the village electric light plant which was recently damaged by fire. The village owes $2,875 in bonds on the plant, and of this amount $1,000 was in the hands of the village treasurer to pay on the bonded indebtedness, leaving a debt of $1,875 on the old plant. The village has left of the old plant the boilers, which were not damaged by the fire, the wires throughout the village, the meters, the ground on which the plant was situated and the old dynamo, which is worth about half what it cost.

COQUILLE, ORE.—A corporation has been formed here called the Coquille Valley Power Company, which is to build a power plant on the east fork of the Coquille River. The capital stock is $50,000, divided into shares of $100 each. Three thousand horse-power can be developed; possibly 4,000, it is claimed. All surveys have been made. From the reservoir the water will be piped 5,000 feet to the power station, where it will have a 3,000 foot fall. From the power station the power will be transmitted to Myrtle Point, Coquille, Bandon, Marshfield and North Bend.

GOLDFIELD, NEV.—A petition has been presented to the county commissioners asking for a franchise for an electric and water power company in Rawhide, the power to be used for domestic and commercial purposes. The project is backed by Toledo capital, and will be chartered with a capitalization of $1,000,000 and an authorized bond issue of $500,000, all of which has been subscribed. William B. Nichols is named as president of the concern, and Z. Wirt as the engineer in charge. Application has been made to the Department of the Interior at Washington and permission granted to go ahead with the work.

PERSONAL MENTION.

MR. W. P. WHITTEMORE, for a number of years superintendent of the electric light plant of North Attleboro, Mass., has resigned.

MR. JOHN M. WOLFF, for four years general manager of the Chambersburg, Greencastle & Waynesboro Street Railway Company, Waynesboro, Pa., has resigned.

MR. OREN ROOT has been elected general manager of the New York City Railway Company, which position has absorbed that of general superintendent, the latter being abolished. This places Mr. Root in complete control of the system.

MR. W. P. ELLIS, of Philadelphia, Pa., has succeeded Henry T. Hall as district manager of the Delaware & Atlantic Telegraph and Telephone Company, at Wilmington, Del. Mr. Hall has returned to the offices of the Bell Telephone Company in Philadelphia.

MR. GEORGE A. McKINLOCK, president of the Central Electric Company, Chicago, arrived in New York April 6 on the Adriatic after a ninety-days' tour through the northern part of Africa and Spain. Mr. McKinlock remained in New York and Boston for a few days before returning to Chicago.

MR. GEORGE L. COLGATE, of Batavia, N. Y., will assume the management of the Ontario Light and Traction Company and the Canandaigua (N. Y.) Gas Light Company on May 1. Mr. Colgate has had considerable experience in the development and management of such enterprises, having formerly been general manager of the Consolidated Gas and Electric Company, of Batavia.

MR. B. A. BEHREND, chief electrical engineer of the Allis-Chalmers Company, and chief engineer of the Buliock Electric Manufacturing Company, has moved his offices from Cincinnati, Ohio, to Milwaukee, Wis. This is in line with the Allis-Chalmers development. For some time the larger electrical machines have been constructed at the West Allis works. A large part of the company's success has been due to its centralizing its entire product in one great organization.

MR. S. E. WOLFF, vice-president and general manager of the Saginaw (Mich.) Valley Traction Company, Bartlett Illuminating Company, Saginaw City Gas Company, Bay City (Mich.) Traction and Electric Company, and Bay City Gas Company, has tendered his resignation, to take a responsible position with Hodenpyl, Walbridge & Company, bankers, of New York city. He is succeeded by John F. Collins, who resigns as manager of railways of the Toledo Railways & Light Company.

NEW INCORPORATIONS.

AUSTIN, TEX.—The Bandera Telephone Company, of Bandera. An amendment to its charter increasing its capital stock from $4,000 to $7,000.

DOVER, DEL.—National Electric Power and Tramway Company. $500,000. To engage in the general construction of railways and power-houses.

SAN JOSE, CAL.—Alviso Electric Light and Power Company. $100,000. Directors: George L. Donovan, James N. Thane, Joseph A. Belloli, Jr.; Theodore Belloli and Leon E. Munier.

AUSTIN, TEX.—Mutual Telephone Company, of Humble. $5,000. To operate a telephone line from Houston to Humble and to Spring. Incorporators: W. M. Abbey, F. M. Burton and J. E. Shankland.

SPRINGFIELD, ILL.—Elgin, Woodstock & Lake Geneva Railroad Company, of Elgin. $25,000. To construct a road from Elgin to the centre of the north line of Richmond township. Incorporators and first board of directors: G. W. Young, of Algona, Wis.; Frank R. Spear, George H. Bryant and William C. Hasse, all of Chicago, and John A. Kirkland, of Elgin.

INDIANAPOLIS, IND.—The Indianapolis, Cloverdale & Terre Haute Traction Company. $10,000. To operate a traction line in territory between Indianapolis and Terre Haute, a large portion of which has not been touched by rail transportation facilities, including the following cities and towns: Indianapolis, West Newton, Mooresville, Gasburg, Monrovia, Hall, Eminence, Cloverdale, Polen, Ashville, Brazil and Terre Haute. Directors: E. M. Bowman, H. T. Butze and Dennis Rutherford, all of Indianapolis.

ELECTRICAL SECURITIES.

The stock market generally was very dull last week, probably owing to the fact that the business session was limited to four days. About the only feature of the market was a revival in speculation for the advance of a number of low-priced and minor-grade industrial stocks. New York city traction shares also made a considerable advance, and this is looked upon as an extremely favorable indication, as a whole. A generally lower tendency prevails in the iron and steel trade, and from some quarters the indications exist that business is not quite as active as it was a month ago. Imports for the month of March were $44,000,000 less than for the same month a year ago. They are, however, larger than for February or January of the present year. The exports were $25,000,000 less than in February, and $64,000,000 less than in January of this year. This is the first month since October of last year that exports have decreased. The balance of trade, however, still stands enormously in our favor, although it is $31,000,000 less than in the preceding month. This certainly indicates that there is a general slackening of trade in Europe as well as here. It might more reasonably be stated that the slackening in trade abroad continues, because there was every indication of this condition there long before we witnessed the business depression and industrial setback here.

Dividends have been declared upon the following electrical securities: Twin City Rapid Transit Company, Minneapolis, Minn.; quarterly dividend of 1¼ per cent on the common stock, payable May 15. Grand Rapids (Mich.) Railway Company; dividend of 1¼ per cent on the preferred stock, payable May 1 to stock of record April 15. Columbus (Ohio) Railway Company; regular quarterly dividend on the preferred stock of 1¼ per cent, payable May 1. Electrical Securities Corporation; semi-annual dividend of 2½ per cent on the preferred stock, payable May 1.

ELECTRICAL SECURITIES FOR THE WEEK ENDED APRIL 18.

New York:	*Closing.*
Allis-Chalmers common	7⅞
Allis-Chalmers preferred	19
Brooklyn Rapid Transit	47¼
Consolidated Gas	118
General Electric	132
Interborough-Metropolitan common	10⅝
Interborough-Metropolitan preferred	29⅛
Kings County Electric (ex interest)	105
Mackay Companies (Postal Telegraph and Cables) common	59⅞
Mackay Companies (Postal Telegraph and Cables) preferred	64½
Manhattan Elevated	127½
Metropolitan Street Railway	31
New York & New Jersey Telephone	102
Western Union	56¼
Westinghouse Manufacturing Company	56¼

Boston:	*Closing.*
American Telephone and Telegraph	116¼
Edison Electric Illuminating	207½
Massachusetts Electric	45
New England Telephone	111
Western Telephone and Telegraph preferred	65

The annual meeting of the New England Telephone Company will be held May 4 at 11 A. M., at 15 Dey street, New York city. Books will be closed from April 20 to May 4, inclusive. A special meeting of stockholders will be held on the same day just preceding the regular meeting, to vote on certain routine matters.

Philadelphia:	*Closing.*
Electric Company of America	9⅝
Electric Storage Battery common	28
Electric Storage Battery preferred	28
Philadelphia Electric	7⅞
Philadelphia Rapid Transit	17⅝
United Gas Improvement	79¼

For the annual meeting of the United Gas Improvement Company, May 4, books closed April 22, and reopen May 5.

Chicago:	*Closing.*
Chicago Telephone	111½
Commonwealth Edison	93
Metropolitan Elevated preferred	47¾
National Carbon common	56½
National Carbon preferred	108

NEW PUBLICATIONS.

THE UNITED RAILROADS BRIBERY CASE—A very interesting document has been published, consisting of the affidavit of Abraham Ruef, filed in the Superior Court for San Francisco, Cal., on Friday, March 20, in the case of the people *versus* Abraham Ruef. This affidavit indicates that efforts were made to induce Ruef to commit perjury by bearing false witness against various officials of the United Railroads of San Francisco. The deponent states at length the efforts made by the prosecution to secure a conviction in the matter of the alleged bribing by the United Railroads of public officials in securing a permit to operate an overhead trolley system.

PUBLIC SERVICE COMMISSION, SECOND DISTRICT, STATE OF NEW YORK—The Public Service Commission of the Second District, state of New York, is sending out form No. 83 to railroad companies for reports on passenger-train movement. This train-movement report exacts data concerning delays under engine failures due to poor fuel, bad water or incompetent engine men; delays caused by repairs to track, repairs or renewals of bridges or any other track structures, unsafe track, washouts, slides, open drawbridges, etc.; delays caused by waiting for trains on other divisions and branches of the reporting railroad; delays caused by waiting for trains on other connecting railroads, or caused by running over the tracks of other railroads; delays caused by mechanical or electrical failure of semaphore or other signals, interlocking plants or any apparatus or mechanism connected with a signal, operators asleep or absent from duty, absence of permission to clear signal, etc.; delays caused by switching, loading or unloading of passengers, baggage or express, blockades at terminal, etc. The report must be filed within thirty days after the end of the month for which the report is compiled. The commission has also published in pamphlet form its opinion concerning the application of the Watertown Light and Power Company for approval of increase of its capital stock and bonded indebtedness. This was submitted on August 17, 1907, and decided March 10 of the present year.

THE KENTENIA CORPORATION—A supplement to the Harlan *Enterprise*, published at Harlan, Ky., dated Friday, April 10, has been received. This is certainly one of the most handsome pieces of corporation publicity that has been produced in a long time. The Kentenia Corporation is organized under the laws of Virginia, with extensive powers for mining, manufacturing and real estate development. The primary object is to acquire mineral lands in Harlan and Bell counties, Ky. The present publication includes a historical review of the plans and purposes of the company and the men who made it. The publication is replete with fine illustrations of the physical properties controlled by the Kentenia Corporation, views of the surveying parties, and typical illustrations of the life, habits and inhabitants of the territory included in the company's property. Two of the leading spirits in this corporation are Charles Henry Davis and Warren Delano, Jr. Mr. Davis is a well-known consulting engineer, and has a large circle of friends and acquaintances in the electrical and allied industries. His earliest connection with the electrical industry was in the Thomson-Houston Electric Company's shops at Lynn, Mass. He has also been connected with the Sawyer-Man Electric Company and the Westinghouse Company. He is a prominent member of all the national engineering societies and an interminable number of social clubs and organizations. He is also an enthusiastic yachtsman, and holds membership in a large number of organizations devoted to this form of sport.

DATES AHEAD.

American Electrochemical Society. Next meeting, Albany, N. Y., April 30-May 2.

Nebraska Electrical Trades Association. First annual electrical show, Auditorium, Omaha, Neb., May 4-9.

Illinois State Independent Telephone Association. Annual convention, Champaign, Ill., May.

Nebraska Electrical Association. First annual meeting, Omaha, Neb., May 6-7.

West Virginia Independent Telephone Association. Annual meeting, Fairmont, W. Va., May 7-9.

Southwestern Electrical and Gas Association. Annual convention, El Paso, Tex., May 7-9.

Railway Signal Association. Next meeting, New York city, May 12.

Grand Rapids Electrical Show Association. First show, Grand Rapids, Mich., May 11-16.

Ohio Society of Mechanical, Electrical and Steam Engineers. Next meeting, Columbus, Ohio, May 15-16.

National Electric Light Association. Annual meeting, Chicago, Ill., May 19-22.

Telephone Association of Texas and Louisiana. Annual meeting, Dallas, Tex., May 25-27.

Oklahoma Electric Light, Railway and Gas Association. Annual meeting, Guthrie, Okla., May 25-27.

American Society of Mechanical Engineers. Semi-annual meeting, Detroit, Mich., June 23-26.

American Institute of Electrical Engineers. Annual convention, Atlantic City, N. J., June 29-July 2.

National Electrical Contractors' Association. Next meeting, Chicago, Ill., July 15.

Michigan Electric Association. Annual meeting, Grand Rapids, Mich., August 18-21.

American Society of Municipal Improvements. Annual meeting, Atlantic City, N. J., October.

INDUSTRIAL ITEMS.

THE J. LANG ELECTRIC COMPANY, 116 North Lincoln street, Chicago, Ill., has ready for distribution its latest catalogue devoted to its electrical specialties.

THE MANHATTAN AUTOCAR COMPANY, New York city, announces that hereafter its sight-seeing cars will leave only from the Times Building, Times Square, Broadway between Forty-second and Forty-third streets.

THE EXCELLO ARC LAMP COMPANY, New York city, on account of the large growth of its business has found it necessary to remove to 30-32 East Twentieth street, where a large store and basement has been leased.

THE HYATT ROLLER BEARING COMPANY, Newark, N. J., in bulletin No. 31, describes and illustrates the Hyatt roller bearing bushing, standard for all conditions of speed and load. Copies of this catalogue will be sent on application.

THE H. W. JOHNS-MANVILLE COMPANY, 100 William street, New York city, has ready for distribution some new literature devoted to "Vulcabeston" packings. New information is also ready concerning the National steel boiler tube cleaner.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., announces the removal of its New York city office to the Cortlandt Building, Hudson Terminal, 32 Cortlandt street. The new location will bring the New York office into closer touch with the works and main office at Ampere, N. J.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., announces that its New York offices, formerly located at 136 Liberty street, have removed to more convenient and commodious quarters on the fourteenth floor of the new Hudson Terminal, Fulton Building, 50 Church street.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., announces that its executive offices, now at 111 Broadway, New York city, and the New York sales offices and export offices, now at 11 Pine street, will hereafter be located in the new City Investing Building, 165 Broadway.

THE LONG BEACH SUPPLY AND FIXTURE HOUSE, 210 East First street, Long Beach, Cal., is in the market for poke-bonnet reflectors and tungsten lamps. There are at present no tungsten lamps in Long Beach, which is a town of over 10,000 population, with electricity very extensively used. William F. King is the proprietor.

THE F. BISSELL COMPANY, Toledo, Ohio, is distributing a series of souvenir postal cards. These cards bring to the attention of the patron the various activities of the Bissell trade-mark frog. The indication is that the frog is "coming their way," and is a neat and attractive means of making an appointment for the company's representative.

THE H. B. CAMP COMPANY, New York city, has published another print of its "Past and Present" series. This is entitled "To the Tournament." This portfolio is beginning to take on some proportions, and is one of the most interesting allegorical depictings of modes of transportation and communication—past and present—that we have seen.

THE DAYTON ELECTRICAL MANUFACTURING COMPANY, Dayton, Ohio, announces the election of Major R. L. Hubler as secretary and general manager of the company. W. D. Brown will continue to act as manager of sales, and R. V. Sutliffe as purchasing agent. The company manufactures the well-known line of

Apple induction apparatus, which will be continued, including everything needed for the ignition of gas engines of every type.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has issued a pamphlet devoted to the setting of valves of Reynolds heavy-duty and "Reliance" Corliss engines. A thorough knowledge of the design and adjustment of the valves is essential to the engineer, and the efficiency of an engine may be seriously impaired by improper setting.

THE STEEL CITY ELECTRIC COMPANY, Pittsburg, Pa., through its New York city representative, William G. Campbell, 220 Broadway, is pushing the introduction of "Star" bushings which it manufactures, claiming for these bushings especially clean threads and ribs for easy turning. These bushings are of malleable iron and are tinned to insure against rusting.

W. N. MATTHEWS & BROTHER, 219 North Second street, St. Louis, Mo., have prepared a new book entitled "Telephone Line Construction." One copy of this book is to be sent free of charge to every operating telephone company in the United States. All duplicate copies will be charged for at the rate of fifty cents each. The information contained in the book has been gleaned from various sources during the past seven or eight years, and represents the expenditure of a great deal of time and money.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has obtained very satisfactory results with the tungsten lamp. Over 75,000 have been shipped to all parts of the country, and the breakage in shipment is below one and one-half per cent. A new bulletin is being issued concerning tungsten lamps, both series and multiple. The company is producing these lamps in large quantities, and is in a position to make prompt shipment, particularly of the 100-watt and all types of tungsten lamps which it has standardized.

THE ELECTRIC CONTROLLER AND SUPPLY COMPANY, Cleveland, Ohio, in the April issue of "Common Sense," shows a very interesting series of illustrations of the installation of the company's magnetic switch controllers at the Bethlehem Steel Company's Saucon plant at South Bethlehem, Pa. These illustrations are rather remarkable in that the controlling apparatus is shown very clearly, while the rest of the detail has been killed off, rendering the controller equipment very prominent. In addition to the descriptive matter concerning this equipment, there are the usual interesting sketches and light reading.

THE LORD ELECTRIC COMPANY, New York city, announces that, although for the past few months, the trade has generally been quiet, there has been no reduction in its working force since the first of the year. The company has been fortunate in closing some very substantial contracts for some of its best-known specialties, and large numbers of Shaw lightning arresters and Earll trolley catchers and retrievers are being sold. The new protective devices which the company is bringing out are meeting with a very pleasing reception. New bulletins will shortly be issued describing some unique features of the company's economizing and protective devices.

THE WHEELER CONDENSER AND ENGINEERING COMPANY, Carteret, N. J., has made arrangements with Charles S. Lewis & Company, Granite Building, Fourth and Market streets, St. Louis, Mo., to handle Wheeler apparatus in the state of Missouri. This includes the well-known Wheeler surface, jet and barometric condensers, feed-water heaters, reheaters and receivers, vertical engines, centrifugal pumps, rotating dry vacuum pumps and vacuum pans, and multiple effects. It also covers the Voltz combined condenser and feed-water heater, Barnard-Wheeler water-cooling towers, and Edwards air-pump. The latter has the unique distinction of replacing the wet vacuum pump, dry vacuum pump and pre-cooler in condenser equipment.

Record of Electrical Patents.

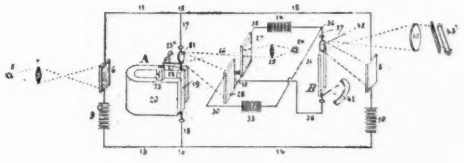
Week of April 14.

884,353. ELECTRIC SWITCH. Herbert H. Berry, Enfield, England. A switch with hinged cover preventing its being closed except when the cover is in place.

884,358. ELECTRICALLY SYNCHRONIZED TIME-MEASURING INSTRUMENT. Bahne Bonniksen, Coventry, and Frederick A. Chandler, Leamington, England. The clock is set by an electromagnet.

884,381. TELEGRAPH TRANSMITTER. Hark S. Haling, Weaver, Minn. A form of telegraph key.

884,397. OVERHEAD TROLLEY. Allen P. Lord and Nathaniel Wilkins, Bradford, Pa. A trolley wheel with a shallow rotatable centre and fixed flanges.



884,501.—Means for Measuring the Degree of Exposure of a Selenium Cell.

884,424. ELECTRICAL FLUID HEATER. Mark T. Seymour, Bemus Point, and Alton W. Ball, Stowe, N. Y. A hollow metallic heater, the heating element being a carbon rod.

884,458. ELECTRIC-CURRENT REGULATOR. Arthur W. Brice, Rochester, N. Y., assignor to Rochester Surgical Appliance Company, Rochester, N. Y. A small rheostat for an incandescent lamp or the like.

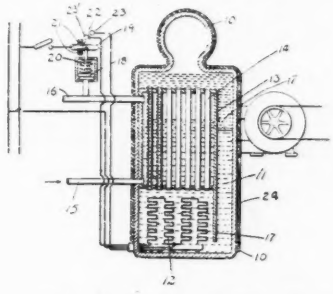
884,499. ELECTRIC SPARK-GAP FOR INTERRUPTERS. Thomas B. Kinraide, Jamaica Plain, Mass. A film of moisture is interposed between the discharge electrodes at the moment of current discharge.

884,500. TELEPHONE DESK-STAND. Anton M. Knudsen, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. A stand with the switch in the base, operated by a switch hook through a toggle movement.

884,501. MEANS FOR MEASURING THE DEGREE OF EXPOSURE OF A SELENIUM CELL. Arthur Korn, Munich, Germany. Two selenium cells are placed in series in a circuit, the effect of light upon the first controlling the exposure of the second to light.

884,511. SELF-STARTER. Walter O. Lum, Schenectady, N. Y., assignor to General Electric Company. An automatic starter comprising electromagnetic switches controlled by thermostatic means.

884,514. AUTOMATIC ELECTRIC SWITCH. Andrew H. Miller, Chesaning, Mich. An automatic flashing switch.



884,540.—Electric Heater.

884,517. CONDUIT ELECTRIC RAILWAY. Lewis W. Musick, Crescent City, Cal. Contact is made with a live conductor by a series of levers pressed down by the plow.

884,519. FUSE HOLDER FOR ELECTRIC-CIRCUIT CONDUCTORS. Patrick McDonald, Rochester, N. Y., assignor of one-half to George Herbert Smith, Rochester, N. Y. A holder for an enclosed fuse, provided with clamping end pieces.

884,540. ELECTRIC HEATER. Elihu Thomson, Swampscott, Mass., assignor to General Electric Company. The heating element is submerged in oil and the latter is allowed to circulate through a second heater containing the material to be heated.

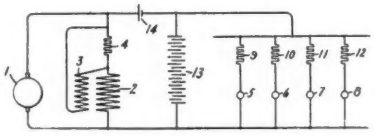
884,541. SYSTEM OF CONTROL FOR ELECTRIC MOTORS. Leonard A. Tirrill, Lynn, Mass., assignor to General Electric Company. A compound-wound motor is run on full field, the armature connections reversed, then excitation due to the shunt field is decreased and the machine run as a series motor.

884,546. TROLLEY WHEEL. Frederick G. Walker, Cleveland, Ohio. A wheel with an annular oil cell.

884,555. REGULATION OF DYNAMOELECTRIC MACHINES. Charles E. Barry, Schenectady, N. Y., assignor to General Electric Company. A shunt machine with an opposing exciting coil connected across a resistance in the shunt circuit.

884,563. PROCESS OF FUSING MATERIALS. George F. Brindley, Niagara Falls, Ontario, Canada, assignor to the Roessler & Hasslacher Chemical Company, New York, N. Y. An insulating layer of unfused material is maintained between the electrodes and the containing vessel.

884,568. MACHINE FOR MAKING INCANDESCENT LAMPS. William R. Burrows, Newark, N. J., assignor to General Electric Company. A sealing-in machine with supports for holding the bulb and stem in alignment.



884,555.—REGULATION OF DYNAMOELECTRIC MACHINES.

884,595. CARRIER SYSTEM. Sam H. Libby, East Orange, N. J., assignor to Sprague Electric Company. A telpherage system in which a number of motors may be controlled by one operator.

884,607. TELEPHONE FIRE-ALARM SYSTEM. William S. McLewee, Yardley, Pa. A fire-alarm system is attached to a telephone line.

884,622. ELECTRIC RAILWAY SIGNAL. George A. Stafford, Belcherville; Ira P. Whitaker, Alvord, and John L. Lopp, Greenwood, Tex. A receptacle for holding an incandescent lamp.

884,624. SOCKET CAP. William S. Stapley, Bridgeport, Ct., assignor to Bridgeport Brass Company, Bridgeport, Ct. A cap with an attached hub.

884,630. TROLLEY POLE AND HEAD. August F. Bauer, Philadelphia, Pa. A pole provided with two wheels.

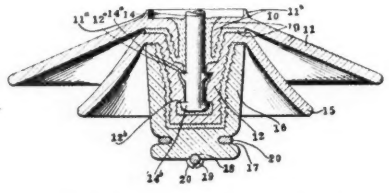
884,637. TELEPHONE ATTACHMENT. William W. Bythiner, Philadelphia, Pa. A wire clamp for holding a number plate, pencil and the like.

884,641. HANGING INSULATOR. Walter G. Clark, New York, N. Y. An insulator built up of a number of shells fitting one into the other.

884,644. SYSTEM FOR ELECTRIC RAILWAYS. Arthur C. Eastwood, Cleveland, Ohio. Certain of the cars throughout the train are equipped with motors, all controlled from one point.

884,645. SYSTEM FOR ELECTRIC RAILWAYS. Arthur C. Eastwood, Cleveland, Ohio. Power is supplied to motors, distributed throughout the train and controlled from one point, by a generator carried on the train.

884,646. ELECTRIC RAILWAY. Arthur C. Eastwood, Cleveland, Ohio. A controlling system for a train with motors placed at various points.



884,641.—HANGING INSULATOR.

884,653. ELECTROLYTIC CELL. George A. Gabriel, New York, N. Y., assignor to Bleach and Caustic Process Company, New York, N. Y. The containing vessel has recesses which form cathode chambers.

884,664. DEPOLARIZER FOR GALVANIC BATTERIES. Ernst W. Jungner, Kneippbaden, Norrköping, Sweden. Nitrosyl-sulfuric acid dissolved in concentrated sulfuric acid.

884,684. TROLLEY HARP AND WHEEL. Edward D. Rockwell, Bristol, Ct., assignor, by mesne assignments, to the New Departure Manufacturing Company, Bristol, Ct. The wheel is carried in journal boxes clamped in the harp.

884,737. SIGNALING SYSTEM. Edward E. Kleinschmidt, New York, N. Y., assignor to George M. Seeley, New York, N. Y. A railway signaling system, the signals of which are controlled by selective devices.

884,738. SIGNALING SYSTEM. Edward E. Kleinschmidt, New York, N. Y., assignor to George M. Seeley, New York, N. Y. A railway signaling system the selective devices of which release the signals allowing them to return to danger.

884,742. ELECTRIC TYPEWRITER. Joseph Lemble, Sennheim, Germany. The various movements of the typewriter are accomplished by electromagnets.

884,750. TROLLEY. Louis C. W. Mitchell and John A. Fretz, Philadelphia, Pa., assignors of one-third to Edward J. Mitchell, Philadelphia, Pa. The harp swivels on the pole.

884,775. ELECTRIC SWITCH. Adolph R. Swoboda, Louisville, Ky. The switch blades are formed of U-shaped members.

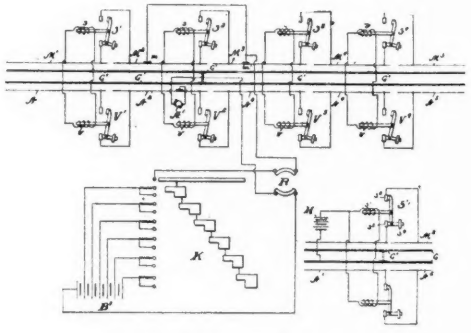
884,783. SIGNAL SYSTEM FOR RAILWAYS. Maximilian G. Voigtlander, Harrison, Ohio, assignor of one-half to James A. Graft, Harrison, Ohio. A signal system for railway crossings utilizing a plurality of traveling recorder contacts.

884,784. SIGNAL SYSTEM FOR RAILWAYS. Maximilian G. Voigtlander, Harrison, Ohio, assignor of one-half to James A. Graft, Harrison, Ohio. A block-signal system utilizing one continuous rail and the other divided into sections.

884,825. AUTOMATIC ELECTRIC CROSSING GATE. Frank G. Layher, Jackson, Mich. The gate is automatically opened and closed by the approach and passing of trains.

884,831. ALTERNATING-CURRENT GENERATOR. Carl A. Lohr, Wilkinsburg, Pa. A generator in which both windings may be connected to a circuit of one frequency or one winding short-circuited on itself and the other connected to a second circuit of different frequency.

884,919. PROCESS FOR MAKING NITROGEN OXIDS FROM AIR. August Grau and Franz Russ, Vienna, Austria-Hungary. The treated gases are withdrawn directly from the central zone of the electric arc.



884,646.—ELECTRIC RAILWAY.

884,920. APPARATUS FOR MAKING NITROGEN OXIDS FROM THE AIR. August Grau and Franz Russ, Vienna, Austria-Hungary. A tube, having an opening substantially the same in diameter as the central zone of the electric arc, is inserted into this zone for withdrawing the treated gases.

884,930. ELECTRODE FOR REVERSIBLE GALVANIC BATTERIES. Ernst W. Jungner, Kneippbaden, Norrköping, Sweden, assignor to Nya Ackumulator-Aktiebolaget Jungner, Stockholm, Sweden. An electrode for an alkaline battery consisting of particles of carbon and a thin coating of metal.

884,969. THERMOSTATIC CIRCUIT CLOSER. Jay O. Woods, Riverside, Wash., assignor of one-half to Joseph W. Graham, Riverside, Wash. The expansion of mercury in a thermometer tube raises a contact and closes the electric circuit.

884,981. SEPARABLE ATTACHMENT-PLUG. Owen E. Kenney, Toledo, Ohio, assignor to the Yost Electric Manufacturing Company, Toledo, Ohio. An attachment-plug with a locking cap.

884,986. WIRELESS TELEGRAPHY. Guglielmo Marconi, London, England, assignor to Marconi Wireless Telegraph Company of America. A receiver depending upon the effect of electric waves on magnetized iron.

884,987. WIRELESS TELEGRAPHY. Guglielmo Marconi, London, England, assignor to Marconi Wireless Telegraph Company of America. A magnetic receiver placed in a rotating electric field.

884,988. DETECTING ELECTRICAL OSCILLATIONS. Guglielmo Marconi, London, England, assignor to Marconi Wireless Telegraph Company of America. The method of detecting electric waves by causing them to act upon a magnetized iron wire.

884,989. WIRELESS TELEGRAPHY. Guglielmo Marconi, London, England, assignor to Marconi Wireless Telegraph Company of America. The method of detecting electric oscillations consists in passing them around an iron member placed in a rotating magnetic field.